

Section H

Transmission

Rear

Suspension

- 1.3 Technical Data
- 2.8 Transmission Removal
- 3.1 Case and Gears
- 5.1 Differential
- 7.2 Rear Suspension
- 8.1 Shifter and Components

General data1584 ccm (96.6 cu in.) engine

Performance

Engine output DIN	48 PS at 4000 rpm
Engine output SAE net	46 bhp at 4000 rpm
Maximum torque DIN	10.2 mkg at 2000 rpm
Maximum torque SAE net	72 lb ft at 2000 rpm
Maximum speed	72 mph

Hill climbing ability
(with two occupants on good roads)

1st gear	approx. 41.5 %
2nd gear	approx. 21.5 %
3rd gear	approx. 12 %
4th gear	approx. 7.2 %

Dimensions and weights

Wheelbase	2400 mm (94.5 in.)
Track, rear	1385 mm (54.5 in.)

Rear axle load (unladen): 530 kg (1166 lbs)

Gross rear axle load 800 kg (1760 lbs)

Transmission ratios (and number of teeth)

1st gear	3.78 (9:34)
2nd gear	2.06 (17:35)
3rd gear	1.26 (23:29)
4th gear	0.93 (58:54)
Reverse	3.79 (12:17 x 15:40)

Final drive ratios (and number of teeth) 4.125 (8:33)

Oil capacity

Transmission and final drive	6.3 US pt. (5.3 Imp. pt.)
Initial filling	5.3 US pt. (4.4 Imp. pt.)
At changes	Hypoid transmission oil SAE 80/90 (MIL-L-2105 B specification)

Code letters

Stamped in front of transmission number AV

Location	Description	Thread	Grade	mkg	lb ft
Transmission and final drive					
Engine/transmission	nut	M 10 x 1.5	8 G	3.0	22
Bearing retainer	nut	M 10 x 1.5	10 K	5.0	36
Transmission/housing	retaining nut	M 80 x 1	Ca 35	22.0*)	160*)
Gear carrier/housing	nut	M 8 x 1.25	6 G	2.0	14
Final drive covers	nut	M 8 x 1.25	8 G	3.0	22
Shift housing/gear carrier	nut	M 7 x 1	6 G	1.5	11
Tapered roller bearing/pinion	round nut	M 35 x 1.5	C 35 N	20.0	144
Ring gear	bolt	M 10 x 1.5	10 K	6.0	43
Selector shaft/fork	bolt	M 8 x 1.25	C 45 KN	2.5	18
Support/reverse lever	nut	M 10 x 1.5	8 G	3.5	25
Bushing/clutch operating shaft	lock bolt	M 6 x 1	8 G	1.0	7
Oil filler hole	plug	M 24 x 1.5	M b K 6	2.0	14
Oil drain hole	magnetic plug	M 24 x 1.5	M b K 6	2.0	14
Rear axle					
Rear wheel or axle shaft	slotted nut	M 24 x 1.5	C 45 KN	35.0	253
Spring plate	nut	M 12 x 1.5	10 K	11.0	80
Control arm	socket head screw	M 14 x 1.5	C 45	12.0	87
Wheel on brake drum	bolt	M 12 x 1.5	CK 35	10.0	72
Spring plate cover	bolt	M 10 x 1.5	8 G	3.5	25
Shock absorber/control arm	nut	M 12 x 1.5	8 G	6.0	43
Shock absorber/frame	nut	M 12 x 1.5	8 G	6.0	43
Bearing cover/wheel bearing	bolt	M 10 x 1.5	8 G	6.0	43
Transmission mounting					
Drive shaft	socket head screw	8 x 1.25	10 K	4.5	32
Transmission carrier/frame	fitted bolt	M 18 x 1.5	8 G	23.0	166
Front transmission mounting/frame	nut	M 10 x 1.5	10 K	3.5	25
Front transmission mounting/shift housing	nut	M 10 x 1.5	8 G	3.5	25
Transmission carrier/rear bonded rubber mounting	nut	M 8 x 1.25	6 G	2.0	14
Rear bonded rubber mounting/transmission housing	nut	M 8 x 1.25	6 G	2.0	14

*) tighten to 22.0 mkg (160 lb ft), loosen, tighten finally to 22.0 mkg (160 lb ft)

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No.	Description	Tool No.	Remarks
1	Engine adapter	VW 612/2	
2	Clamp for fuel hose	—	
3	Multi-point socket wrench	US 1038	100 mm (4.0 in.) long
4	T-handle wrench	VW 114	



Fig. 1

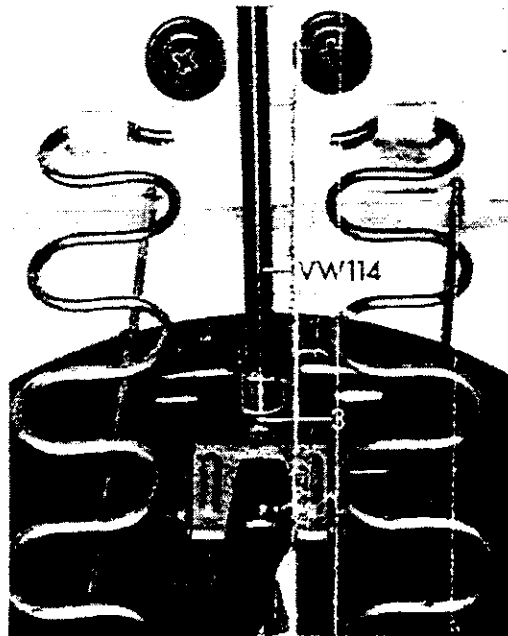


Fig. 2



Fig. 3

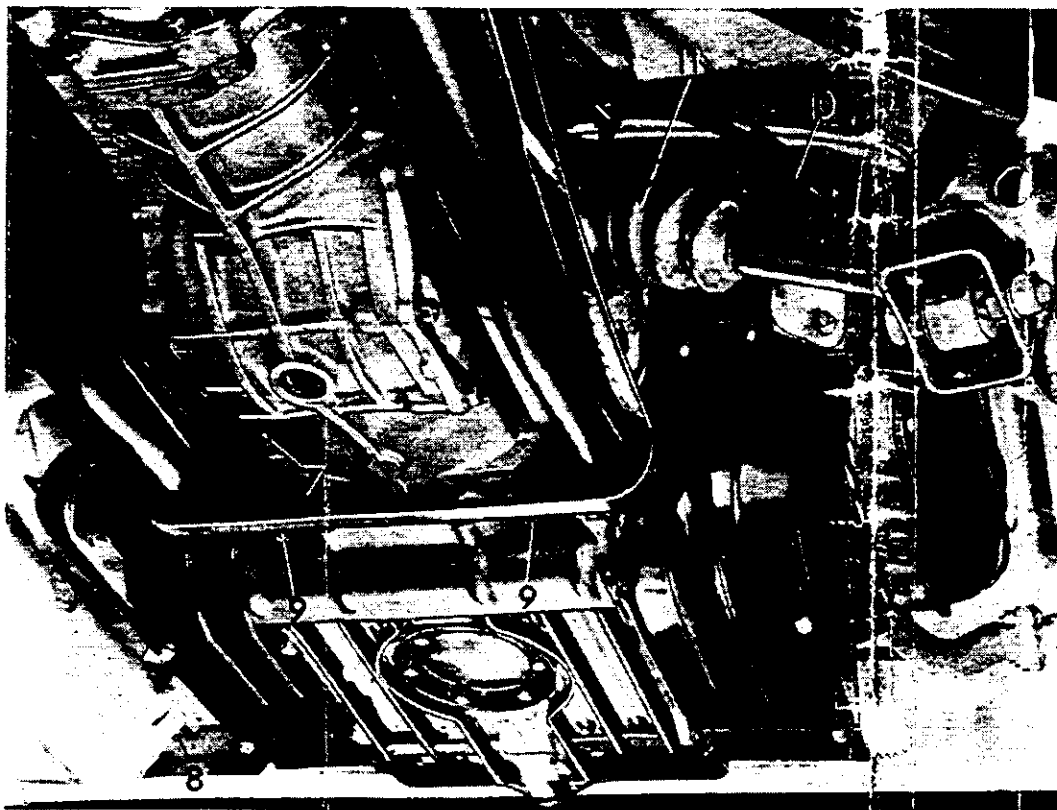


Fig. 4

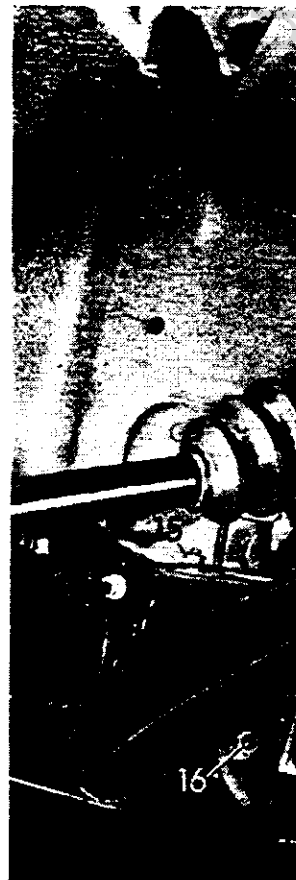


Fig. 5

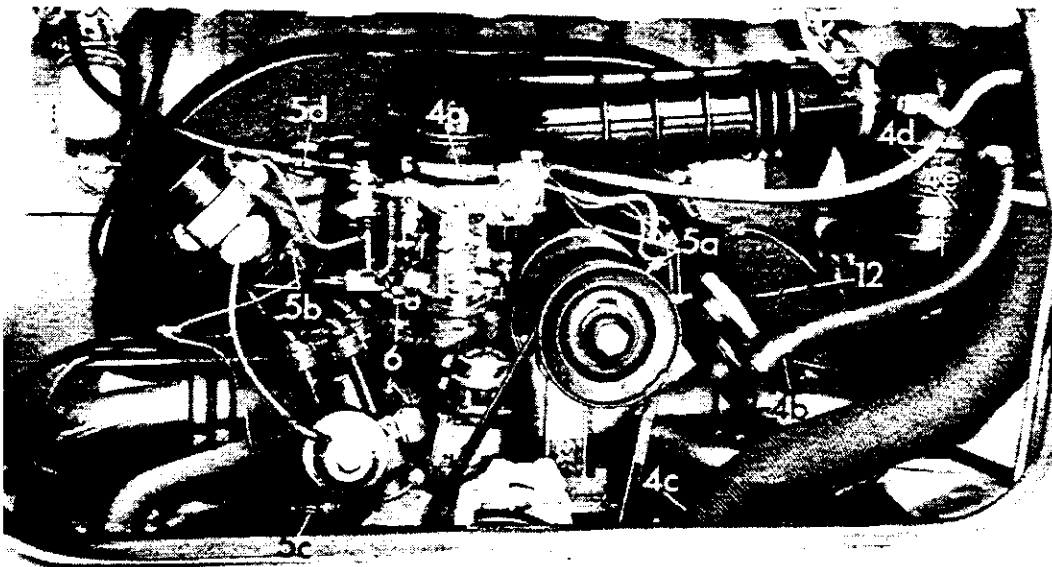


Fig. 3

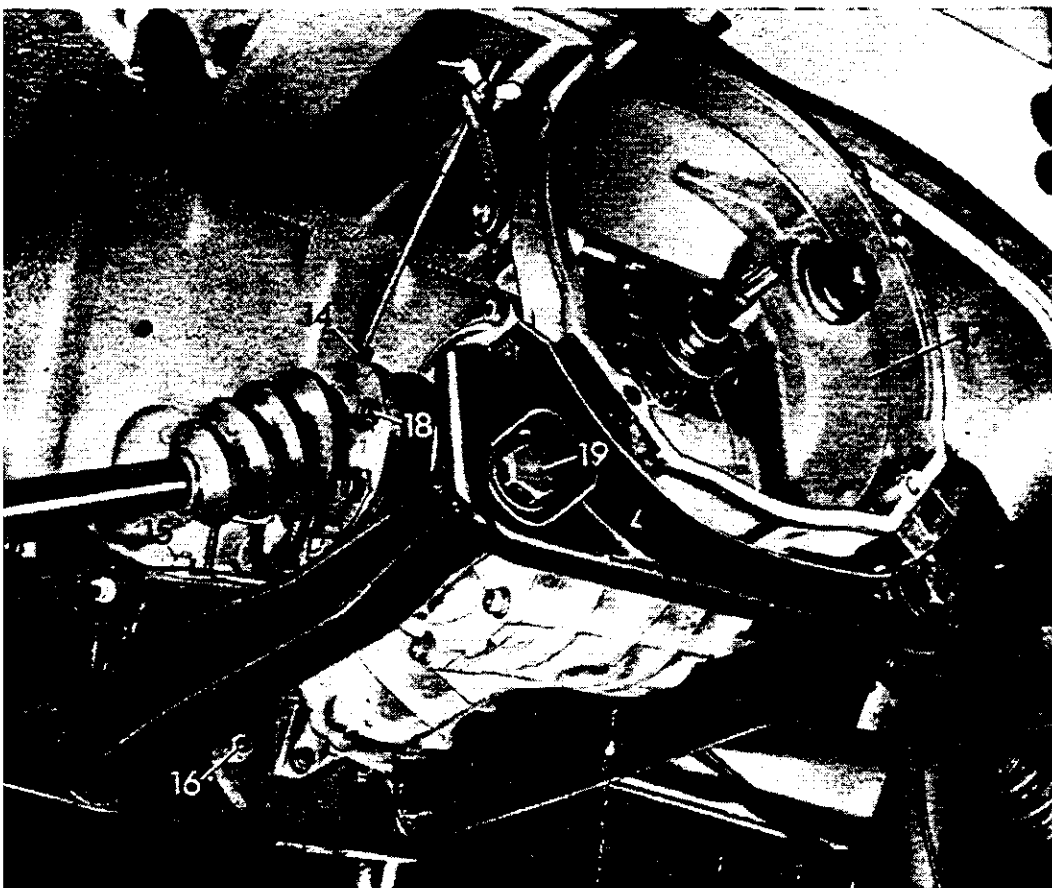
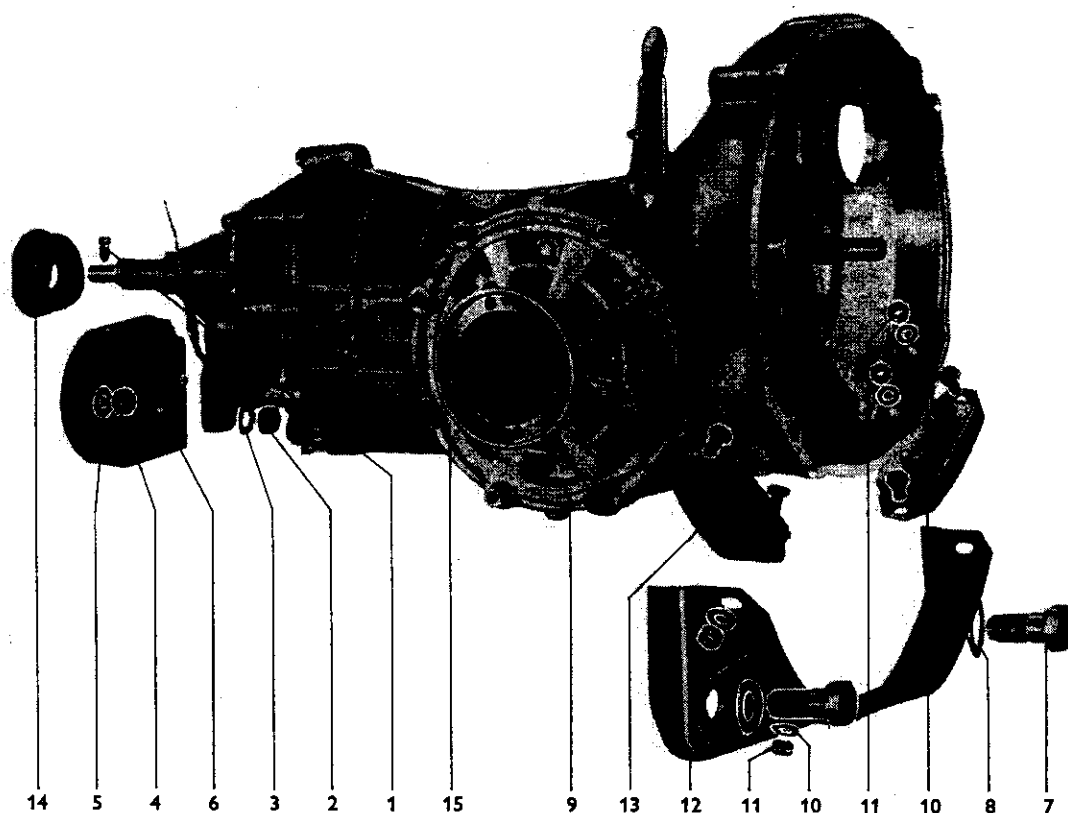
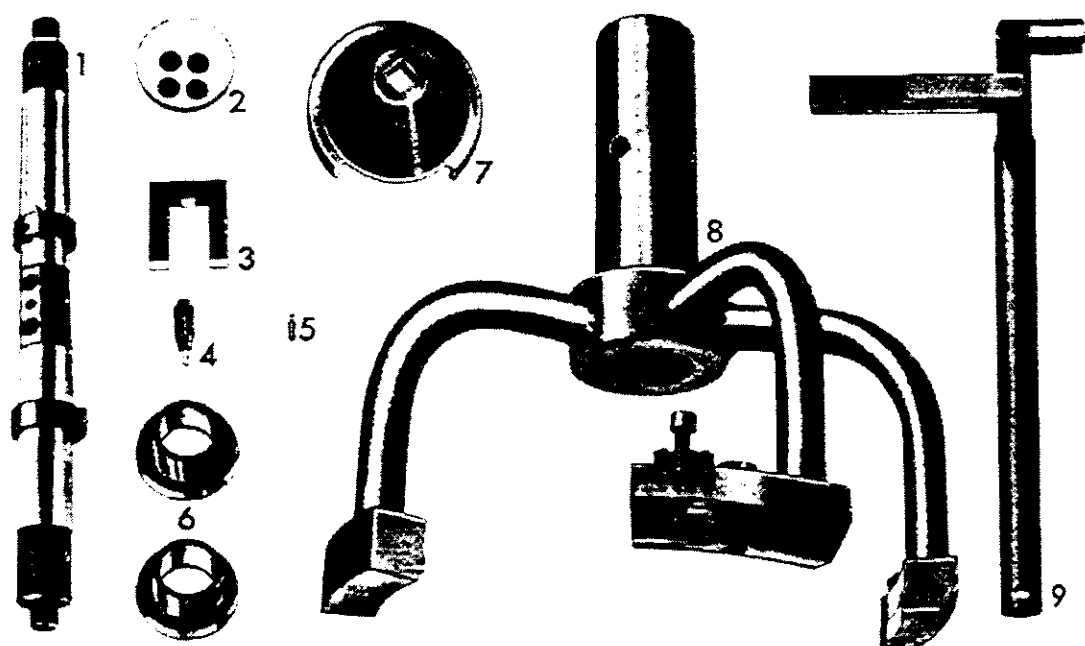


Fig. 5

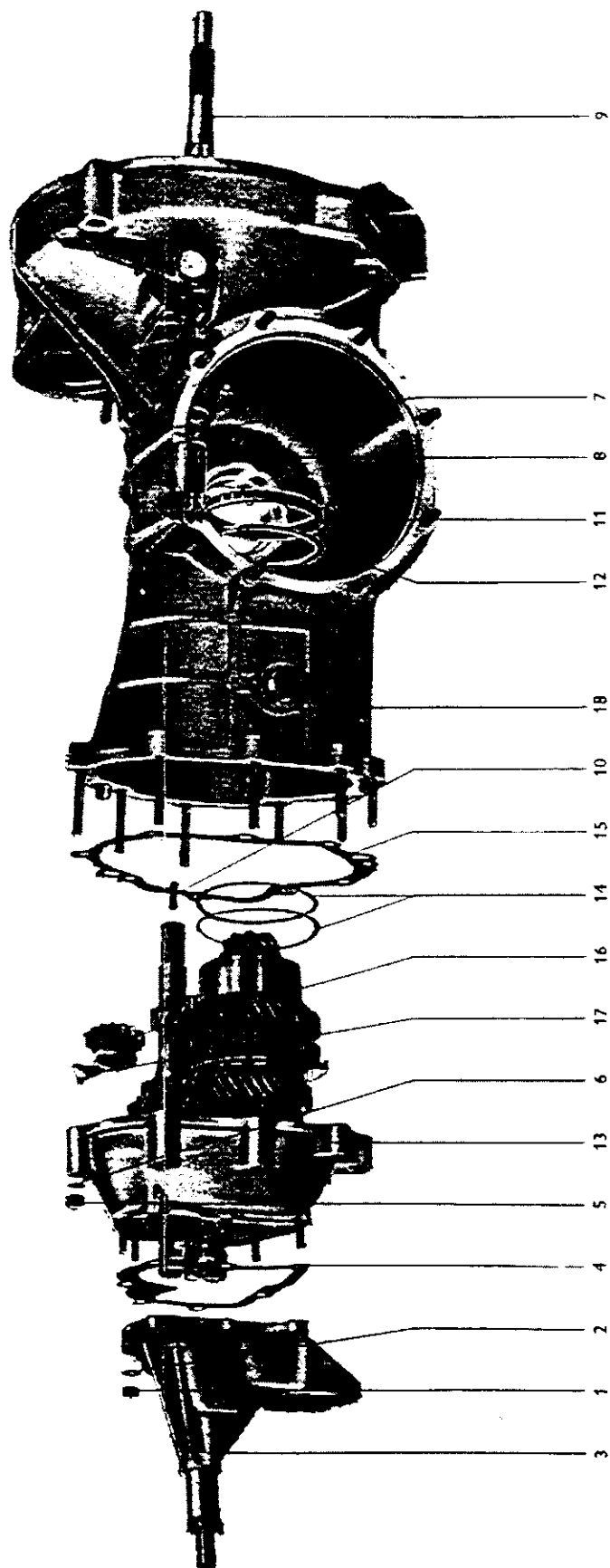
No.	Description	Qty.	removing	Note when installing	Special instructions see
1	Rear seat	1	unhook springs		Fig. 1
2	Battery ground strap	1	disconnect	connect	Fig. 1
3	Square headed bolt	1	loosen with VW 114	tighten with VW 114	Fig. 2
4	Oil bath air cleaner	1	remove	install	Fig. 3
	a) clamp	1	loosen	tighten	
	b) breather hose	1	pull off	install	
	c) preheating hose	1	pull off	install	
	d) vacuum hose	1	pull off	install	
	e) clamp	1	loosen	tighten	
5	Electrical wiring				Fig. 3
	a) on generator	4	disconnect	connect	
	b) on ignition coil	2	disconnect	connect	
	c) oil pressure switch	1	disconnect	connect	
	d) backup light	1	disconnect	connect	
6	Accelerator cable	1	disconnect	to adjust, depress gas pedal all way down. Pull cable all way back and clamp on throttle lever 1 mm (0.04 in.) before full throttle position	Fig. 3
7	Nut of engine mounting bolt	2	loosen	tight to 3.0 mkg (20 lb ft)	Fig. 4
8	Clamp for tail pipe	2	loosen and remove pipes	install pipes and tighten	Fig. 4
9	Protection plate bolts	2	remove	tighten nuts to 2.0 mkg (14 lb ft)	Fig. 4
10	Fuel hose	1	pull off and plug with VW 647	install	Fig. 4
11	Nut of engine mounting bolt	1	loosen	tighten to 3.0 mkg (20 lb ft)	Fig. 4
12	Nut of engine mounting bolt	1	loosen and remove engine with adapter VW 612/2	tighten to 3.0 mkg (20 lb ft)	Fig. 3
13	Clutch adjusting nut	1	remove	install and adjust to correct clutch pedal play	Fig. 5
14	Clutch cable guide tube bracket	1	remove	tighten nuts to 3.0 mkg (20 lb ft)	Fig. 5
15	Transmission ground strap	1	remove	tighten nuts to 3.0 mkg (20 lb ft)	Fig. 5
16	Nuts for bonded rubber mounting	2	remove	tighten to 3.5 mkg (23 lb ft)	Fig. 5
17	Nuts of starter terminal	1	remove and detach starter		Fig. 5
18	Socket head bolts of drive shafts	12	remove	tighten to 4.5 mkg (33 lb ft)	Fig. 5
19	Bolts of transmission carrier	2	remove	tighten to 23.0 mkg (166 lb ft)	Fig. 5



No.	Description	Qty.	removing	Note when installing	Special instructions see
1	Square head bolt	1	remove with VW T14	lock with wire	
2	Nut	2		tighten to 3.5 mkg (23 lb ft)	
3	Lock washer	2			
4	Nut	2		tighten to 3.5 mkg (23 lb ft)	
5	Lock washer	2			
6	Bonded rubber mounting	1			
7	Bolt	2		tighten to 23 mkg (166 lb ft)	
8	Lock washer	2			
9	Bolt	4		tighten to 2.0 mkg (14 lb ft)	
10	Lock washer	8			
11	Nut	8		tighten to 2.0 mkg (14 lb ft)	
12	Transmission carrier	1			
13	Bonded rubber mounting	2			
14	Bellows	1			
15	Transmission	1			



No.	Description	Special Tool	Remarks
1	Universal measuring bar	VW 385/1	
2	Measuring plate	VW 385/17	
3	Setting gauge	VW 385/9	
4	Measuring pin	VW 385/14	
5	Dial indicator extension	VW 385/15	
6	Centering disc (2)	VW 385/2	
7	Socket	VW 381/14	
8	Holding fixture	VW 307 a	
9	Lever	VW 296	



H 3.1 Manual Transmission

Note: Before the gear train can be removed, the differential must be removed, (see H 5.1/11)

No.	Description	Qty.	Note when disassembling	Note when assembling	Special instructions see
1	Nut M 7 x 1	7	loosen	tighten to 1.5 mkg (10 lb ft)	
2	Spring washer	7			
3	Shift housing	1	detach	when installing make sure that inner shift lever is positioned correctly	Fig. 4 H 3.1/15-1
4	Gasket, shift housing	1		replace	
5	Nut	9	loosen	tighten to 2.0 mkg (14 lb ft)	
6	Spring washer	9			
7	Circlip	1	remove	replace	
8	Reverse sliding gear	1			
9	Drive shaft rear	1	unscrew front and rear part of drive shaft	screw the two parts together as far as possible first and then loosen until the splines for reverse sliding gear are in line.	Fig. 1
10	Stud M 6	1			
11	Retaining nut	1	loosen with VW 381/14; If the double tapered roller bearing or/and the transmission housing must be replaced the position of the drive pinion in the transmission case must be determined before removing. On installation make sure that the drive pinion is in the same position as determined before.	tighten with VW 381/14 to 22.0 mkg (160 lb ft), loosen, tighten finally to 22.0 mkg (160 lb ft)	Fig. 3
12	Shim	1			
13	Gear carrier, assembly	1	press out with VW 296	align the double tapered roller bearing first to housing, then drive on drive pinion by using a plastic hammer. When doing this, turn the reverse gear shaft, so that the gear can slide on the splines of the shaft.	Fig. 2
14	Shims "Ss"	x	note thickness	measure again if necessary	
15	Gasket	1		replace	
16	Reverse gear on drive pinion	1		lubricate lightly	
17	Shift fork	1			
18	Transmission case	1	if case is to be replaced, first determine position of drive pinion in case	if replacing case adjust drive pinion and ring gear	H 3.1/13

Disassembling

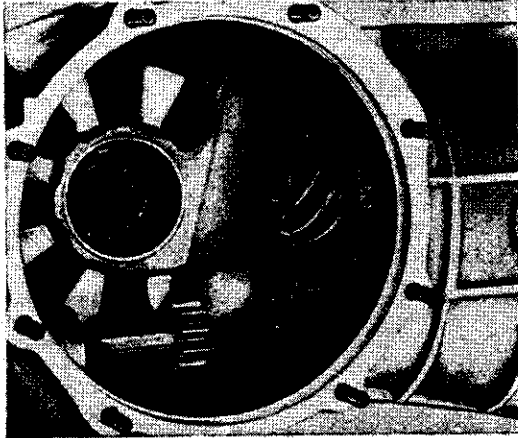


Fig. 1

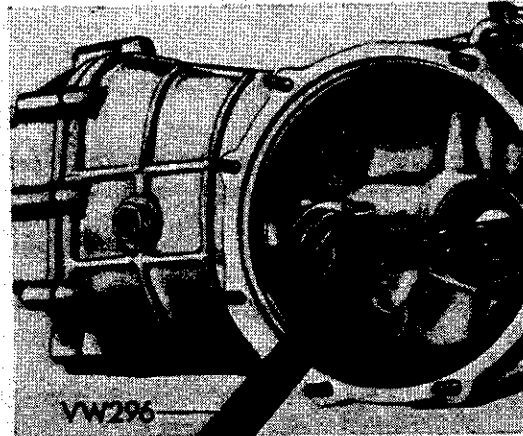


Fig. 2

Assembling

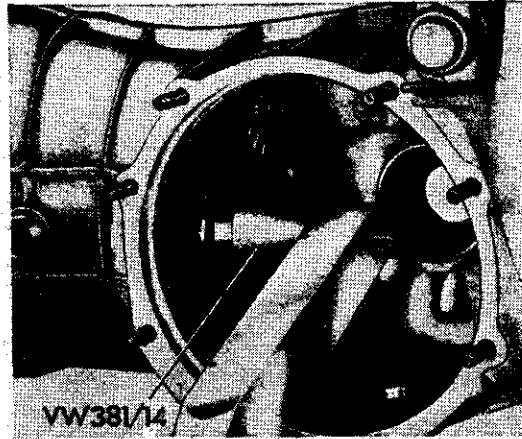


Fig. 3

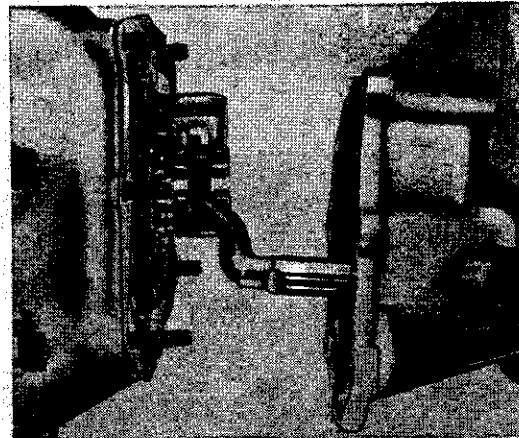


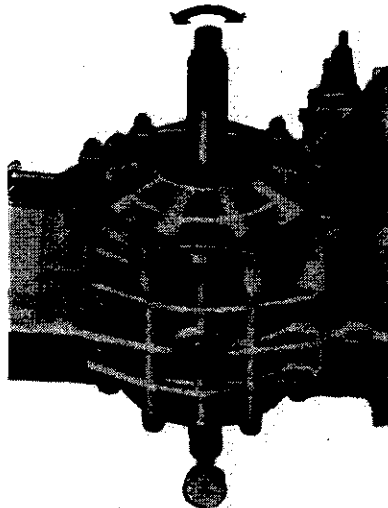
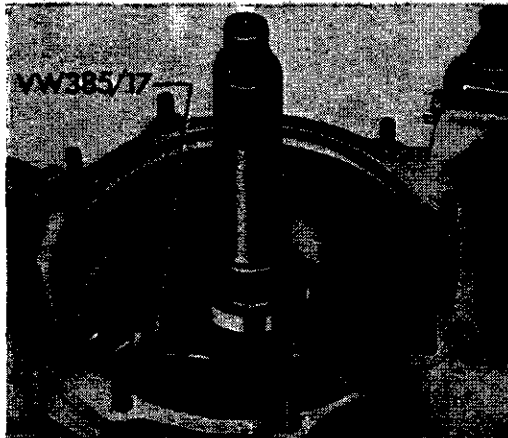
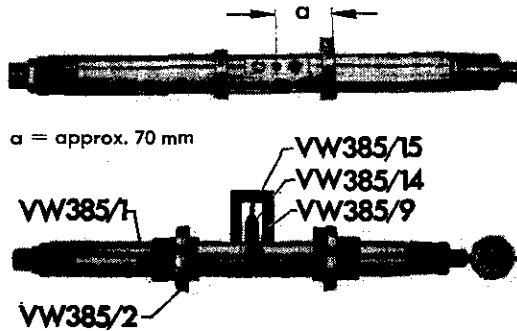
Fig. 4

Determining position of drive pinion

This operation is necessary if the dimension "a" is not marked on the ring gear and the double tapered roller bearing or transmission case must be replaced.

If the drive pinion and ring gear must be replaced adjust according to instructions as given in H 5.1/13.

- 1 - Disassemble transmission without removing drive pinion.
- 2 - Set the ring on the universal measuring bar VW 385/1 to dimension "a".



- 3 - Place setting gauge VW 385/9 ($R_o = 58.70 \text{ mm}$) on the bar and zero dial indicator (3 mm range) with 1 mm preload.

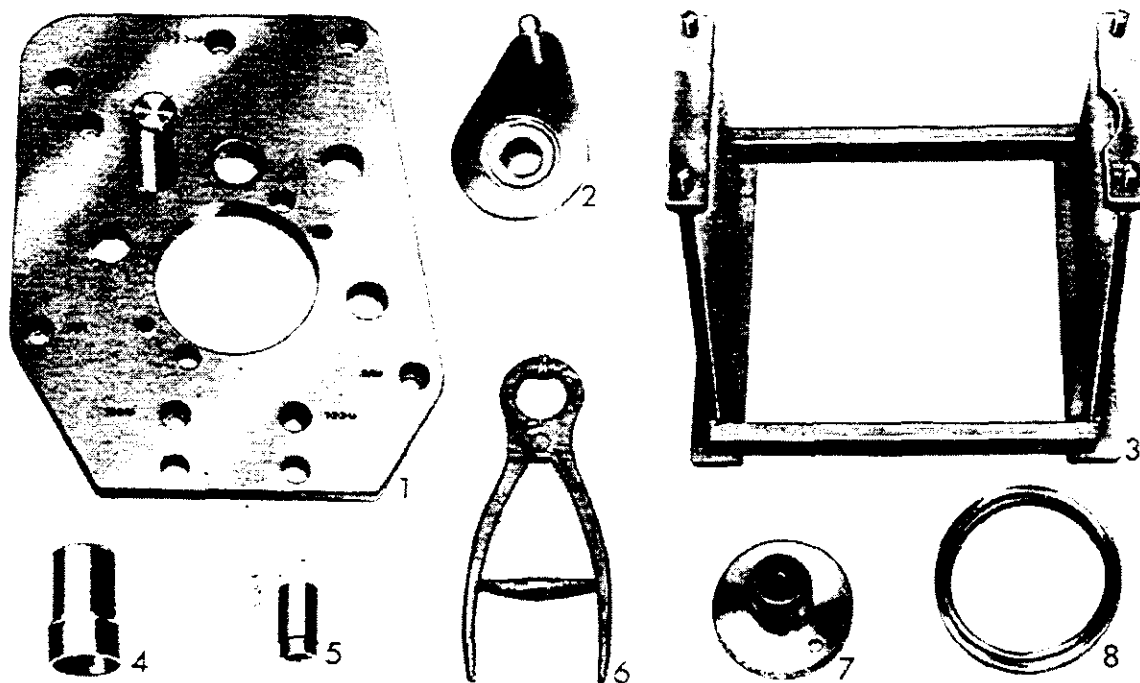
Note

Move the sliding ring back to the stop.

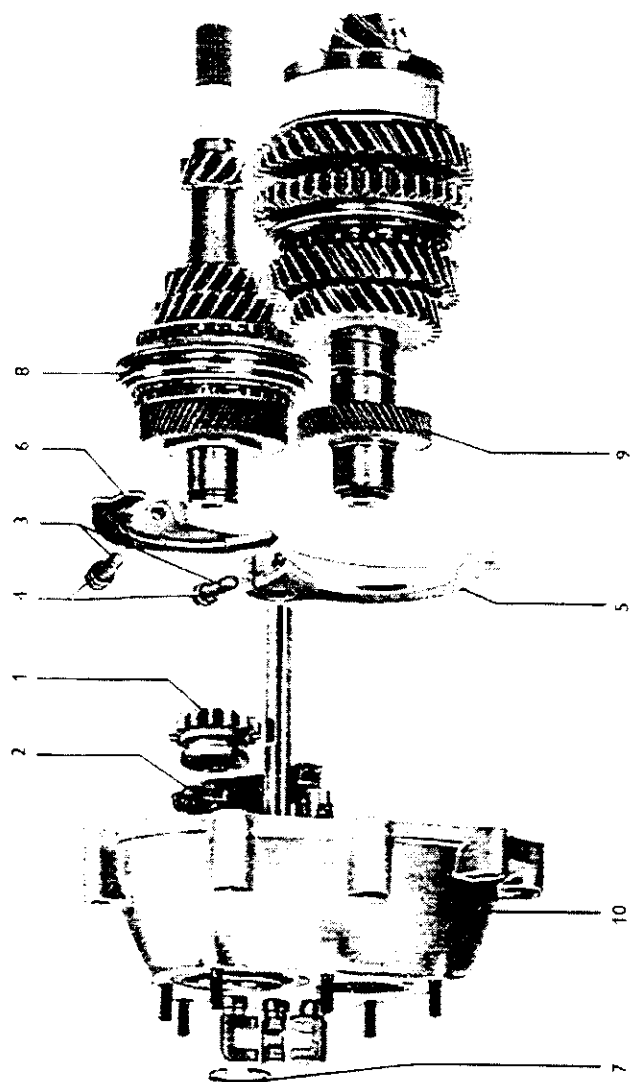
- 4 - Place measuring plate VW 385/17 on end of drive pinion and insert universal measuring bar.
- 5 - Install cover, tighten nuts to correct torque.
- 6 - Push the setting ring of the second centering disc outward until the bar can just be turned by hand.

- 7 - Turn the bar until the dial indicator pin contacts the measuring plate on the drive pinion and the dial indicator pointer reaches the return point.

- 8 - Note the determined dimension. When assembling the transmission (especially after replacement of double tapered roller bearing or case), the drive pinion position must be within $\pm 0.04 \text{ mm}$ (0.001 in.) of the determined dimension.



No.	Description	Special Tool	Remarks
1	Setting appliance	VW 294 b	
2	Crank	VW 294	
3	Support	VW 456	
4	Adapter	VW 454	
5	Arbor	VW 434	
6	Circlip pliers	VW 161 a	
7	Thrust disc	VW 412	
8	Retaining ring	VW 294 a/10	



No.	Description	Qty.	Note when disassembling	Note when assembling	Special instructions see
1	Reverse sliding gear	1		oil when installing	H 3.1/8-2
2	Shifting fork	1			
3	Bolt	2	loosen	tighten to 2.5 mkg (18 lb ft)	
4	Spring washer B 6	2			
5	Shifting fork 1st/2nd gear	1	pull selector shaft back, remove fork and shift in neutral	adjust with VW 294 b	Fig. 2 H 3.1/9-4
6	Shifting fork 3rd/4th gear	1	slide off selector shaft	adjust with VW 294 b	H 3.1/9-3
7	Circlip	1	remove with VW 161 a	install with VW 161 a squeeze all around with waterpump pliers for proper seating.	H 3.1/9-3 Fig. 1 Fig. 3
8	Drive shaft, assembly	1	press out of gear carrier with VW 412, VW 434 and VW 456. When doing this, guide the shaft and drive pinion carefully to avoid damage to the teeth. Also make sure that the shifting fork for 3rd/4th gear does not jam.	press in with VW 412, VW 454 and VW 401. Guide shaft and drive pinion carefully to avoid damage to the teeth. Also make sure that the 3rd/4th gear shift fork is positioned correctly.	H 3.1/9-3 Fig. 3 Fig. 4
9	Drive pinion, assembly	1			
10	Gear carrier	1			

Removing

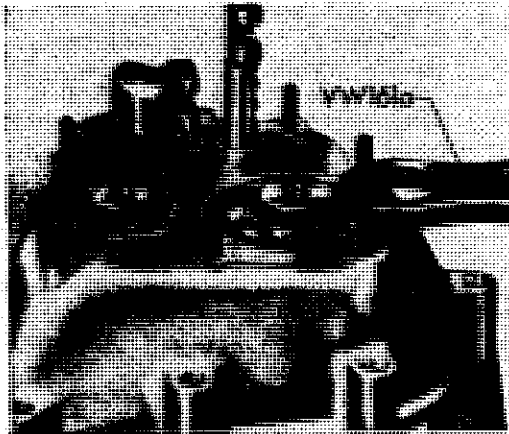


Fig. 1



Fig. 2

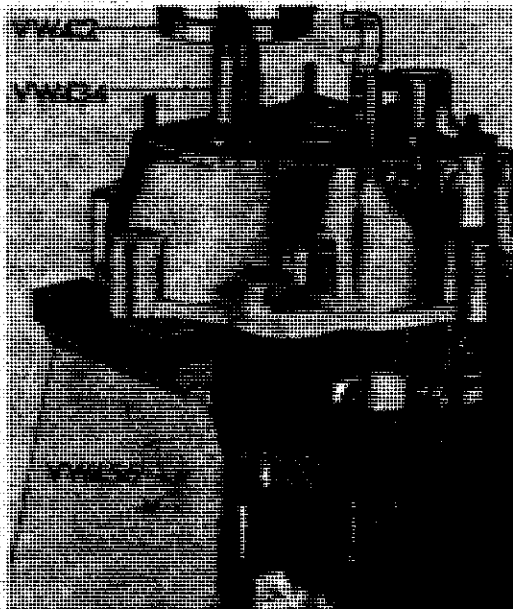


Fig. 3

Installing

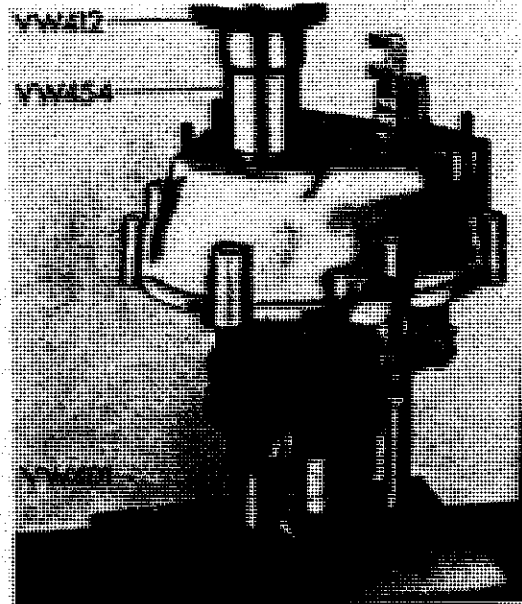


Fig. 4

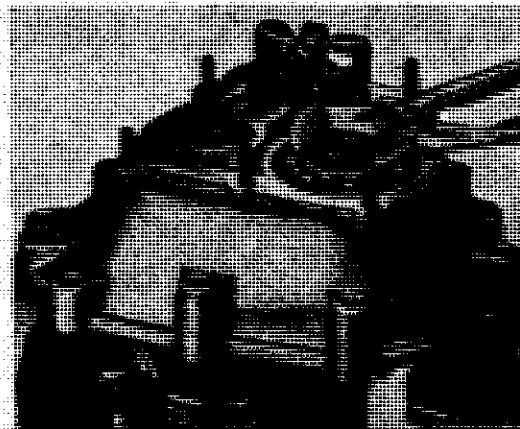
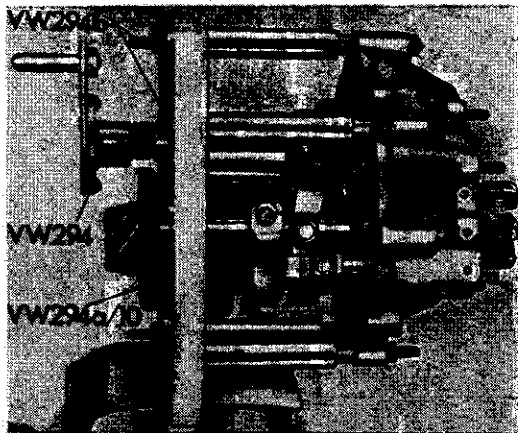


Fig. 5



1 - The shift forks can only be adjusted properly with the setting appliance VW 294b. The pinion and drive shaft must be fitted in the appliance in exactly the same position as they will later be in the transmission case. To achieve this, the setting shim "S 3" for the axial location of the pinion must be determined before and installed in the appliance. The paper gasket must not be used between the gearshift housing and the spacer sleeves of the appliance.

2 - Install gear carrier assembly without gasket, drive pinion with shim, drive shaft, and reverse gear with four nuts in appliance VW 294b. Tighten retaining ring VW 294a/10 on drive pinion head.

Caution

The shift fork for 1st/2nd gears (wider fork) is installed with the profile towards the gear carrier. The profile of the 3rd/4th gear fork, however, is away from the gear carrier.

3 - Install shift fork for 1st/2nd gear and tighten clamp bolt.

4 - Locate lower selector shaft (for 1st/2nd gear) in the notch for 2nd gear. Slide operating sleeve with fork over the coupling teeth until it is against the 2nd gear.

Centralize the shift fork in the groove in the operating sleeve and tighten clamp bolt.

Caution

The shift forks must not rub or exert pressure on the sides of the groove in the operating sleeve when in neutral or when a gear is engaged. **There must always be clearance.**

5 - Select 1st/2nd gears and neutral several times while turning the transmission and check clearance between shift fork and operating sleeve in each position. If necessary, alter the shift fork position until there is the same clearance between fork and groove in both end positions. Tighten clamp bolt to 2.5 mkg (18 ft lb).

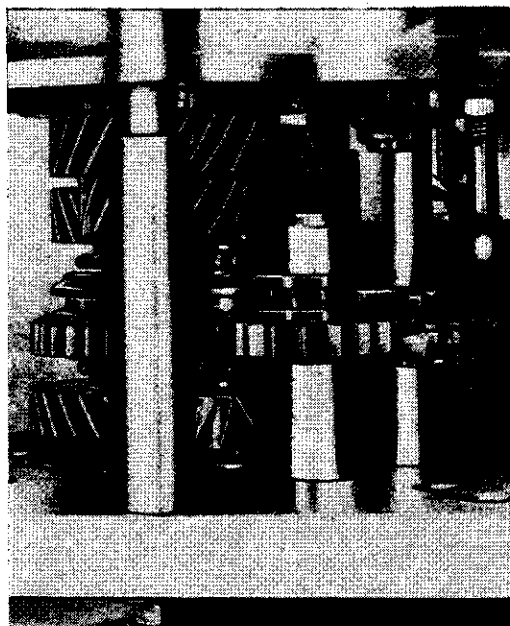
6 - Locate upper selector shaft (for 3rd/4th gears) in the notch for 3rd gear. Adjust fork for 3rd/4th gears in the same way as for 1st/2nd gear. Tighten clamp bolt to 2.5 mkg (18 ft lb).

Caution

For a correct adjustment of 3rd and 4th gears the ball bearing in the gear carrier must be pressed in fully.

- 7 - Adjust the reverse gear shift fork so that the sliding gear engages fully with the reverse gear of the drive pinion.

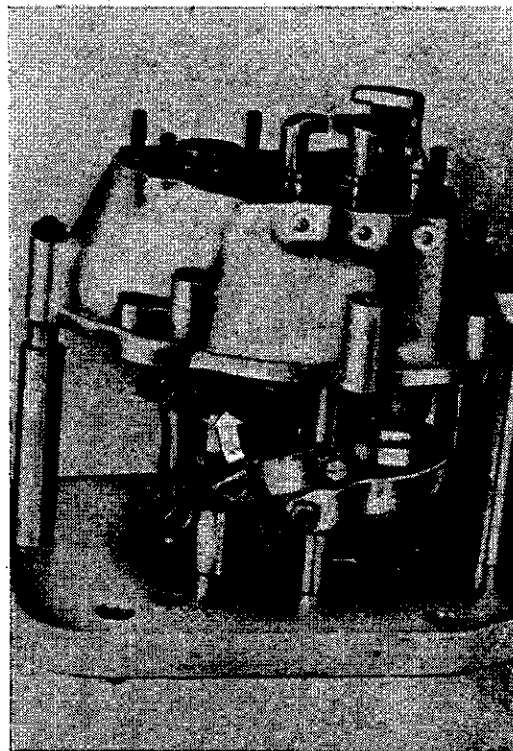
Tighten the bolt in the relay lever guide to 2 mkg (14 ft lb).



Caution

When adjusting the reverse sliding gear, make sure that there is no axial play at the shift fork.

If necessary, loosen support for relay lever and press relay lever in direction of sliding gear (arrow) until only the running clearance remains.



- 8 - Engage 2nd gear and check clearance of gear and operating sleeve of 1st/2nd gear and 3rd gear on drive shaft. Rectify if necessary.

- 9 - Check selector shaft interlock. **When a gear is engaged it must not be possible to engage another gear.** The selector shafts are all interlocked one against the other.

Assembling

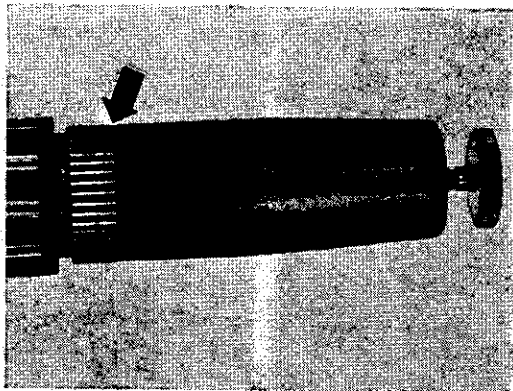


Fig. 3

Slide sleeve over the shaft until it contacts the splines for the synchronizer hub (arrow). This may involve screwing out the knurled thumb screw.

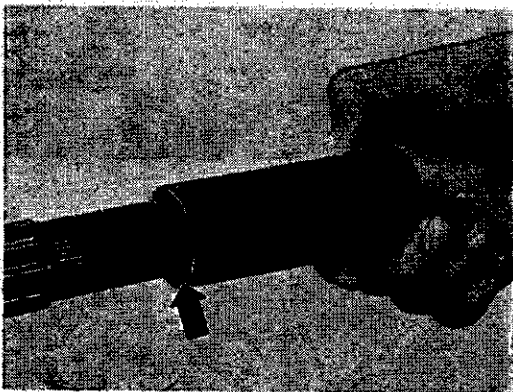


Fig. 4

Place a new circlip into recess of tube and push it along the sleeve and over the splines with the tube until it snaps into the groove.

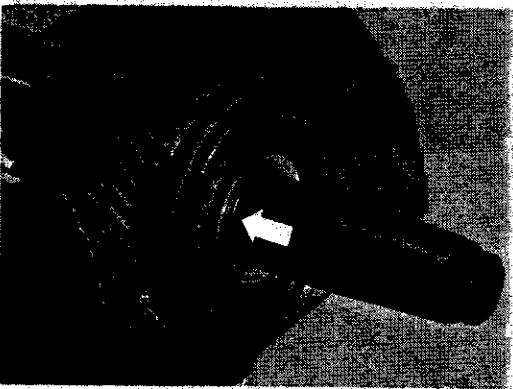


Fig. 5

Slide sleeve over shaft again and screw in the knurled thumb screw until the groove for the circlip is exposed (arrow). Push second circlip on with tube until it engages.

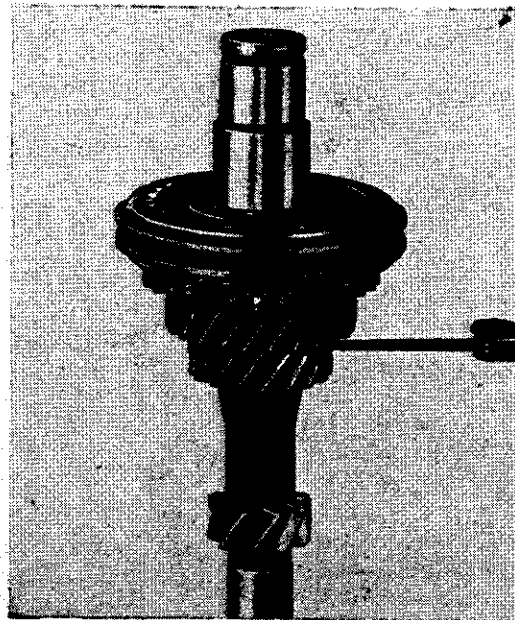


Fig. 6

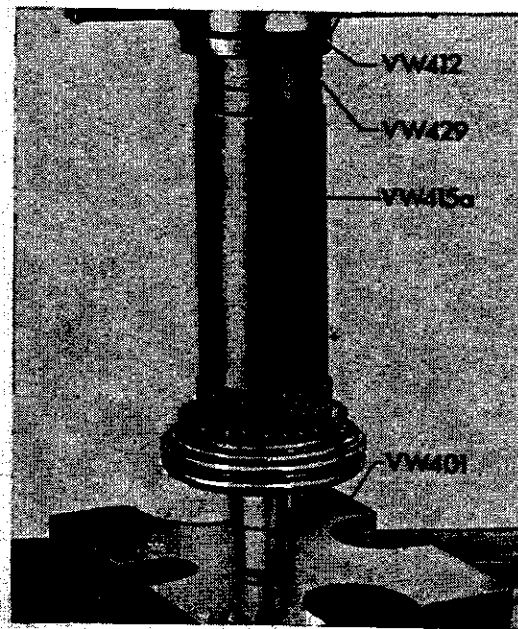
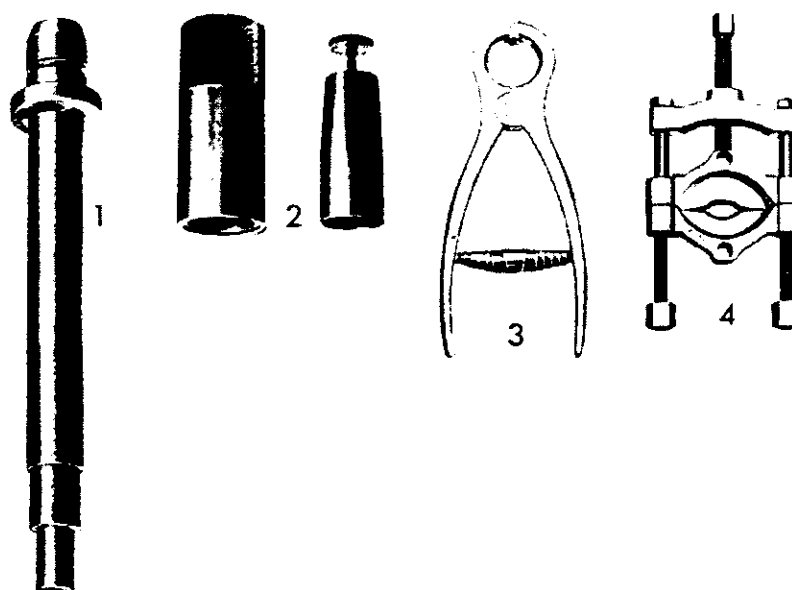
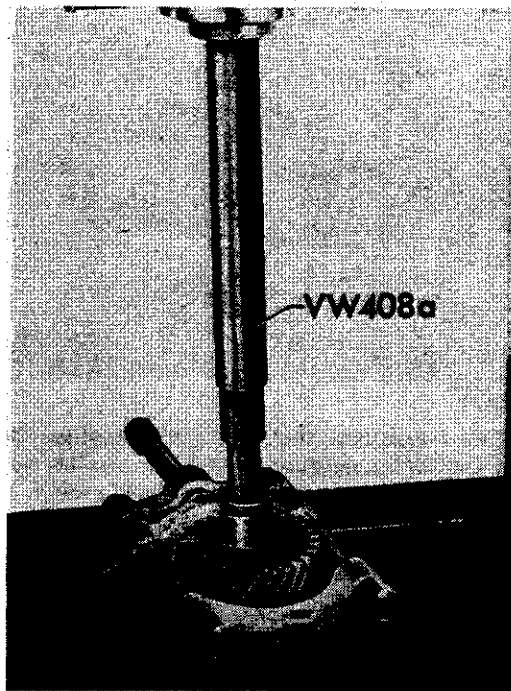
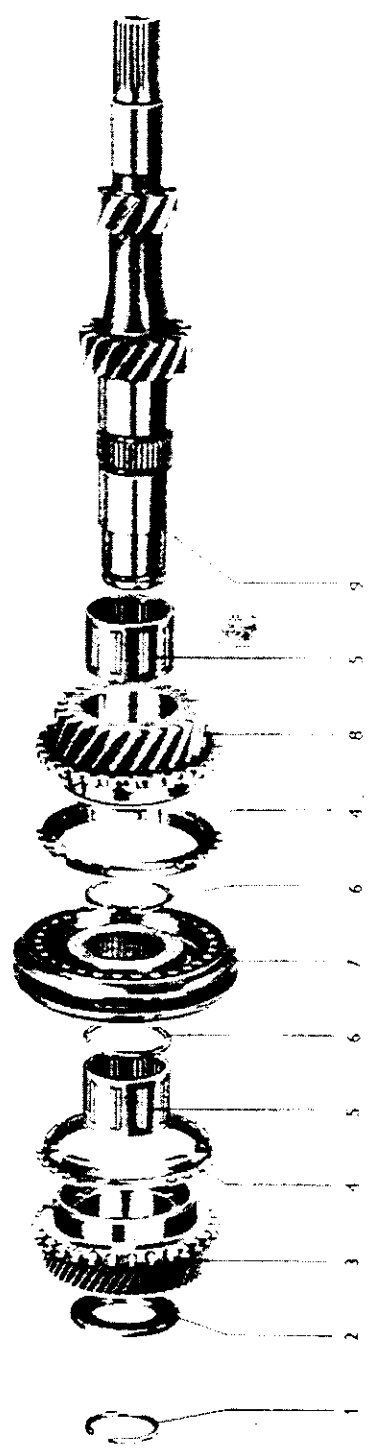


Fig. 7



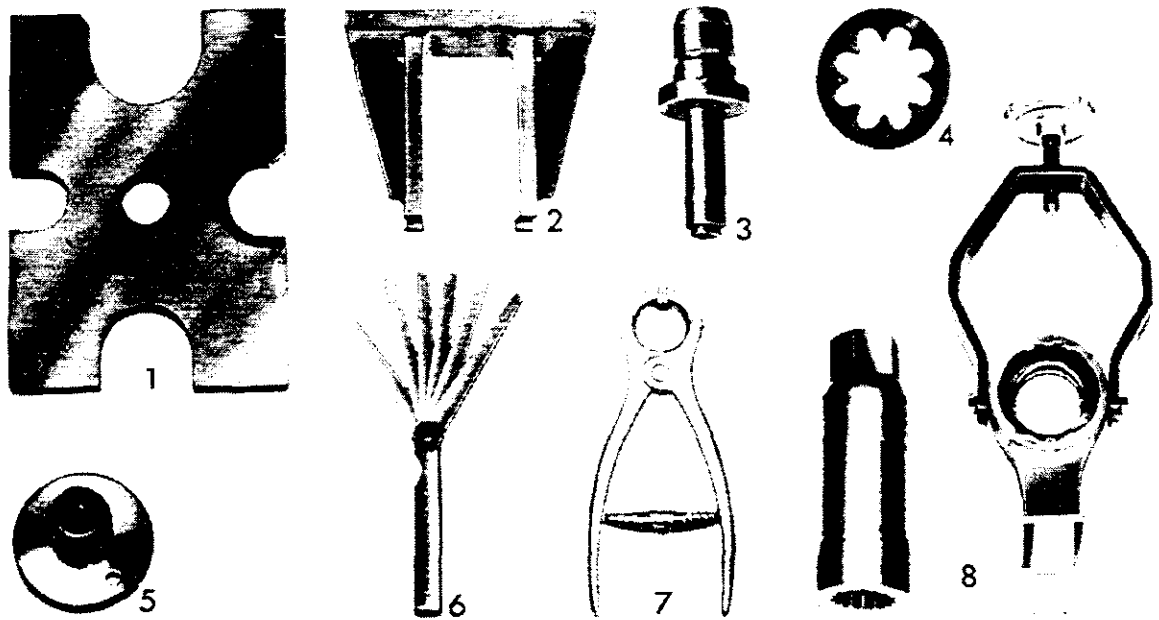
No.	Description	Special Tool	Remarks
1	Punch	VW 408	
2	Assembling tool	VW 284	
3	Circlip pliers	VW 161 a	
4	Separating tool	US 4439	

Disassembling**Fig. 1****Fig. 2**

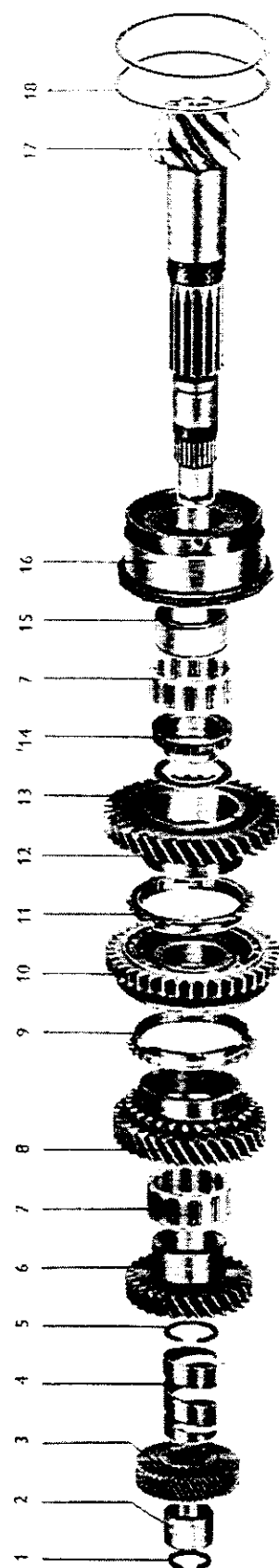


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No.	Description	Qty.	removing	Note when installing	Special instructions see
1	Circlip	1	with VW 161 a	squeeze with waterpump pliers for proper seating	
2	Thrust washer, 4th gear	1	check for scoring	warm up	Fig. 1
3	4th gear	1	use VW 408 a and separating tool	replace only as a set	Fig. 1
4	Synchronizer ring, 3rd and 4th gear	2		check for wear	
5	Needle bearing, 3rd and 4th gear	2		use only slotted cages with needles in pairs	
6	Circlip	2	with VW 161 a	with VW 284 check clearance between 2nd and 3rd gear. If clearance is less than 0.15 mm (0.006 in.) press 3rd gear carefully with VW 401, VW 412, VW 415 a and VW 429	Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6 Fig. 7
7	Synchronizer hub, assembly	1	press off with 3rd gear together	the groove in the hub faces 4th gear the groove in the splines must faces the 3rd gear	
8	3rd gear teeth of gear for Type 1/sedans and Type 3 smaller than teeth of gear for Type 1/Model 181	1	press off with VW 401 and VW 411 together with synchronizer	replace only as a set	3.2/12
9	Drive shaft, front	1			



No.	Description	Special Tool	Remarks
1	Thrust plate	VW 401	
2	Removal device	VW 460/3	
3	Punch	VW 409	
4	Thrust ring	VW 449 f	
5	Punch	VW 412	
6	Feeler gauge	—	
7	Circlip pliers	VW 161 a	
8	Holding fixture	VW 293	



H3.1 Manual Transmission

No.	Description	Qty.	Note when disassembling	Note when assembling	Special instructions see
1	Circlip	1	press 4th gear down with VW 460 3 and remove with VW 161 a	install inner race-heated up to about 100 °C (212 °F) — first and press 4th gear down with VW 460 3. Use VW 161 a.	Fig. 1 Fig. 10 Fig. 11
2	Inner race	1	press off with 4th gear together, use VW 401 and VW 408 a	heat to about 100 °C (212 °F) and press on with VW 401, VW 412, VW 422	Fig. 2 Fig. 11
3	4th gear	1	press off with inner race together	replace only as a set. The hub must face 4th gear	Fig. 2
4	Spacer spring	1			
5	Circlip, 3rd gear	1	use VW 161 a	use VW 161 a, adjust axial play to 0,1—0,25 mm (0,004—0,010 in.), use feeler gauge	Fig. 9
6	3rd gear teeth of gear for Type 1/sedan and Type 3 smaller than teeth of gear for Type 1/Model 181	1		replace only as a set	
7	Needle cage for 1st and 2nd gear	2			
8	2nd gear	1		replace only as a set if teeth are damaged	
9	Synchronizer stop ring 2nd gear	1		check for wear. Ring has 3 notches around the outer diameter. Do not interchange with synchronizer stop ring for 1st gear.	
10	Synchronizer hub 1st and 2nd gear	1		the hub and the groove must face 2nd gear	
11	Synchronizer stop ring 1st gear	1		check for wear. Do not interchange with ring for 2nd gear.	
12	1st gear	1		replace only as a set if teeth are damaged	
13	Spacer washer	x		adjust axial play to 0,1—0,25 mm (0,004—0,010 in.), use feeler gauge	Fig. 8
14	Round nut	1	loosen with VW 293	replace, tighten in VW 293 to 20,0 mkg (145 lb ft), peen shoulder. Install in transmission case, tighten nut of double tapered roller bearing and check turning torque of bearing.	Fig. 6 H 5.1/13 Fig. 7
15	Inner race	1	press off together with double tapered roller bearing	heat to install, press in position	
16	Double tapered roller bearing	1	press off with VW 401, VW 409 and VW 449	heat to install, press into position. Install in transmission case, tighten nut and check turning torque of bearing.	Fig. 3 Fig. 4 Fig. 5 H 3.1-8
Note On gear set — ratio 8:31 — press double tapered roller bearing off without using VW 449 f. Use separating tool to press ring off when replacing the bearing, determine first				position of drive pinion into transmission case and note. To perform this check it is necessary to install the pinion with the "old" bearing in the case. Also check turning torque.	
17	Drive pinion	1		replace drive pinion and ring gear only as a set, if a new drive pinion is installed a new adjustment is necessary	H 5.1 13
18	Shim "S"	x	note thickness	install correct shim	

Disassembling and assembling drive pinion Types 1 and 3 from November 1972

Disassembling

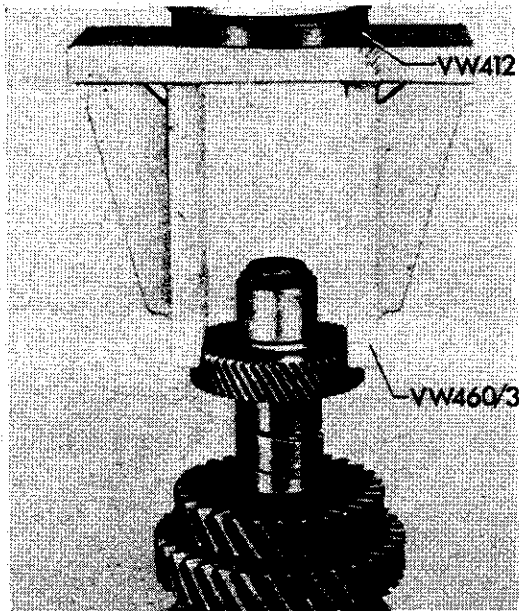


Fig. 1

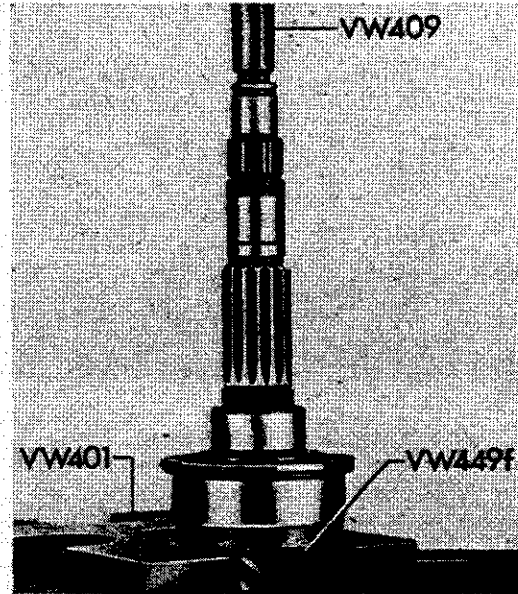


Fig. 3

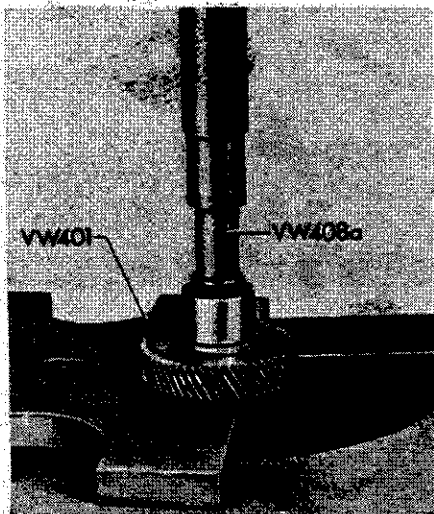


Fig. 2

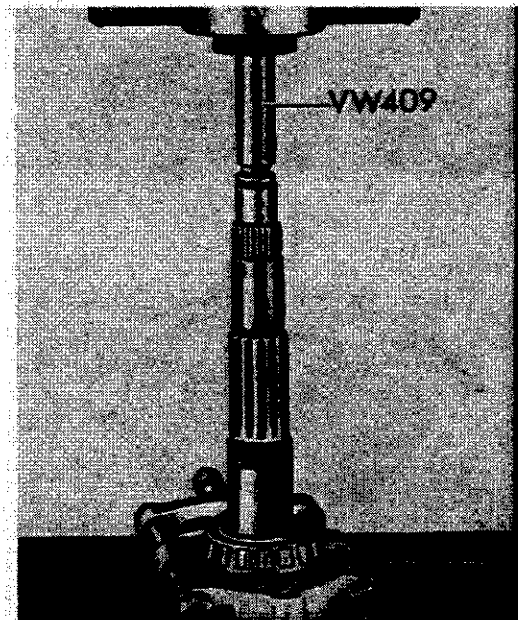


Fig. 4

Assembling

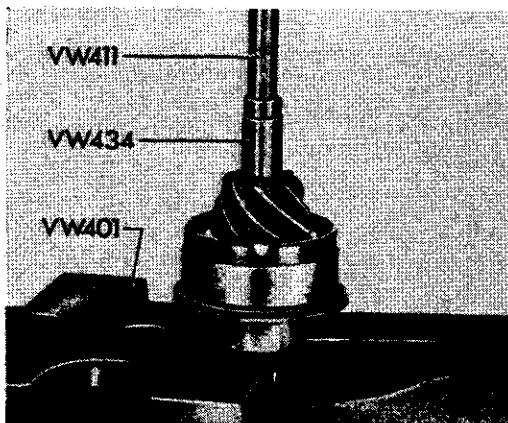


Fig. 5



Fig. 6

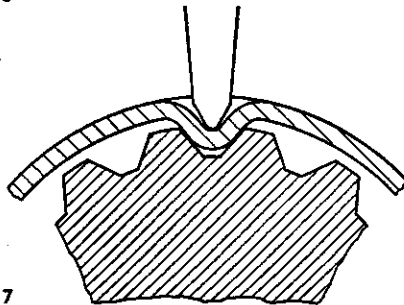


Fig. 7

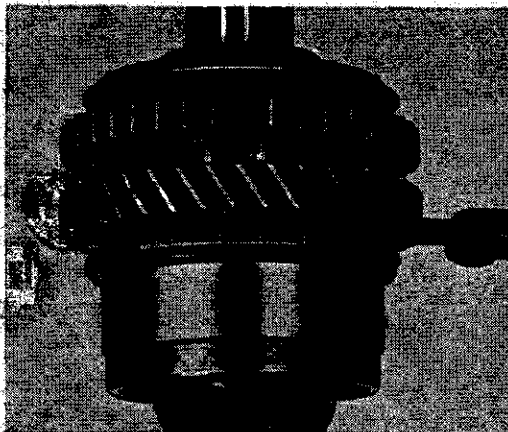


Fig. 8

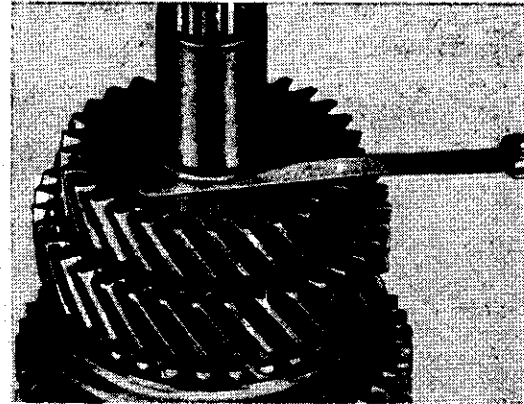


Fig. 9

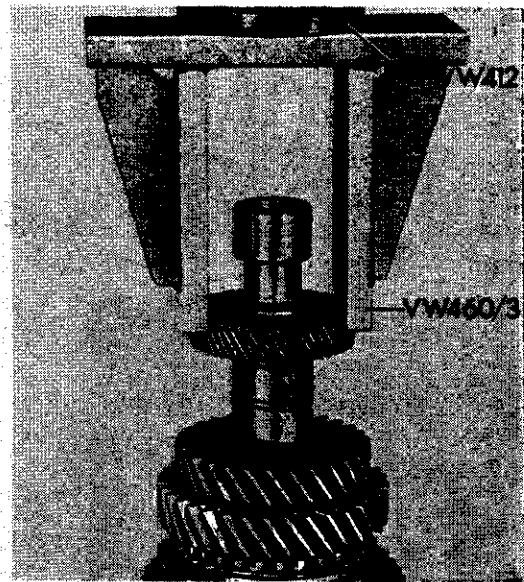


Fig. 10

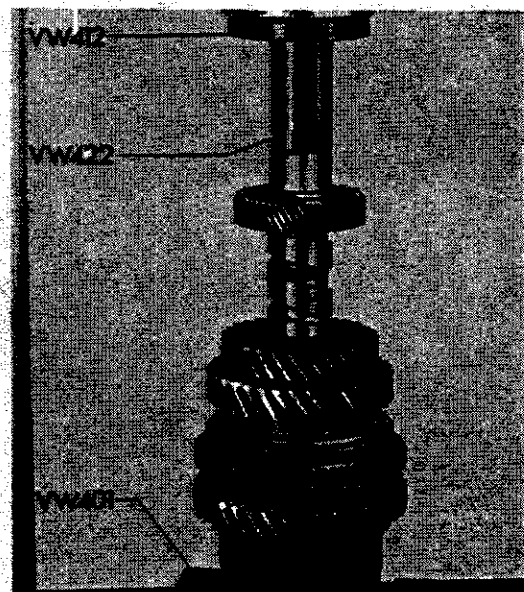
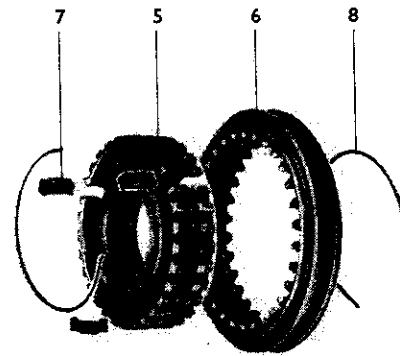
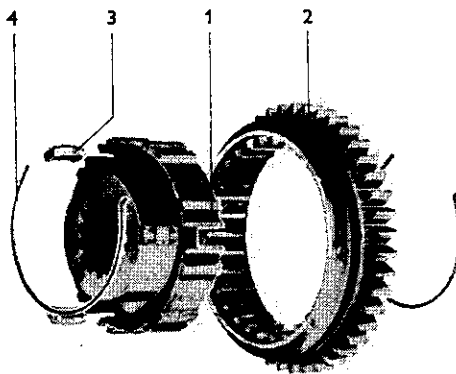


Fig. 11



No.	Description	Qty.	disassembling	Note when assembling	Special instructions see
1	Synchronizer hub, 3rd and 4th gear	1		the side with the groove all around must be on 3rd gear side	Fig. 4
2	Operating sleeve, 3rd and 4th gear	1		the side with the groove all around must be on 4th gear side	Fig. 4
3	Synchronizer key, 3rd and 4th gear	3		note difference of keys for 1st and 2nd gear	
4	Synchronizer key spring 3rd and 4th gear	2		install 120° offset, check tension, the spring ends must fit right over the keys	Fig. 3 Fig. 1
5	Synchronizer hub, 1st and 2nd gear	1		the wider hub is on the 2nd gear side	
6	Operating sleeve, 1st and 2nd gear	1		the slot for the shift fork must be on the 2nd gear side	
7	Synchronizer key, 1st and 2nd gear	3		note difference of keys for 3rd and 4th gear	
8	Synchronizer key spring, 3rd and 4th gear	2		install 120° offset, check tension, the spring ends must fit right over the keys	Fig. 3 Fig. 1

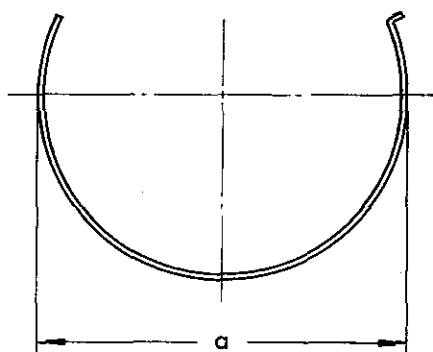


Fig. 1



Fig. 2

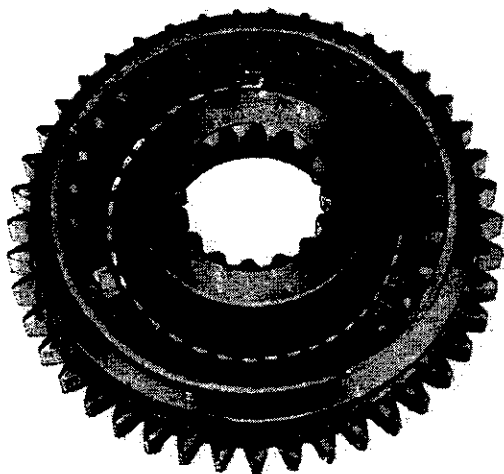


Fig. 3

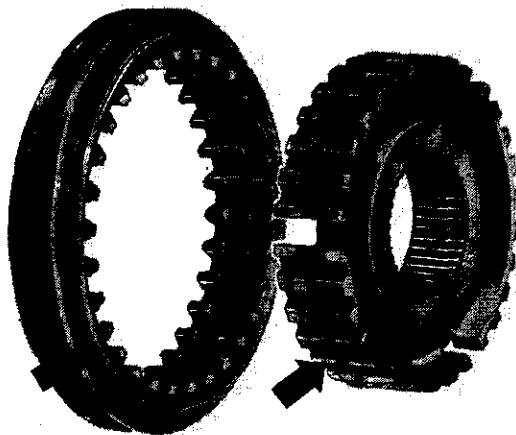


Fig. 4

Checking

Check tension of spring by measuring diameter of unloaded spring. If the following measurements — *a* — are not obtained, replace.

1st and 2nd gear = 78 mm $\pm$ 1 mm diameter
(3.070 in. $\pm$ 0.04 in.)

3rd and 4th gear = 74 mm $\pm$ 1 mm diameter
(2.913 in. $\pm$ 0.04 in.)

Press synchronizer rings over cones on gears and measure gap "*a*" with a feeler gauge.

1st and 2nd gear:

new installation: 1.1—1.8 mm (0.043—0.070 in.)
wear limit: 0.6 mm (0.024 in.)

3rd and 4th gear:

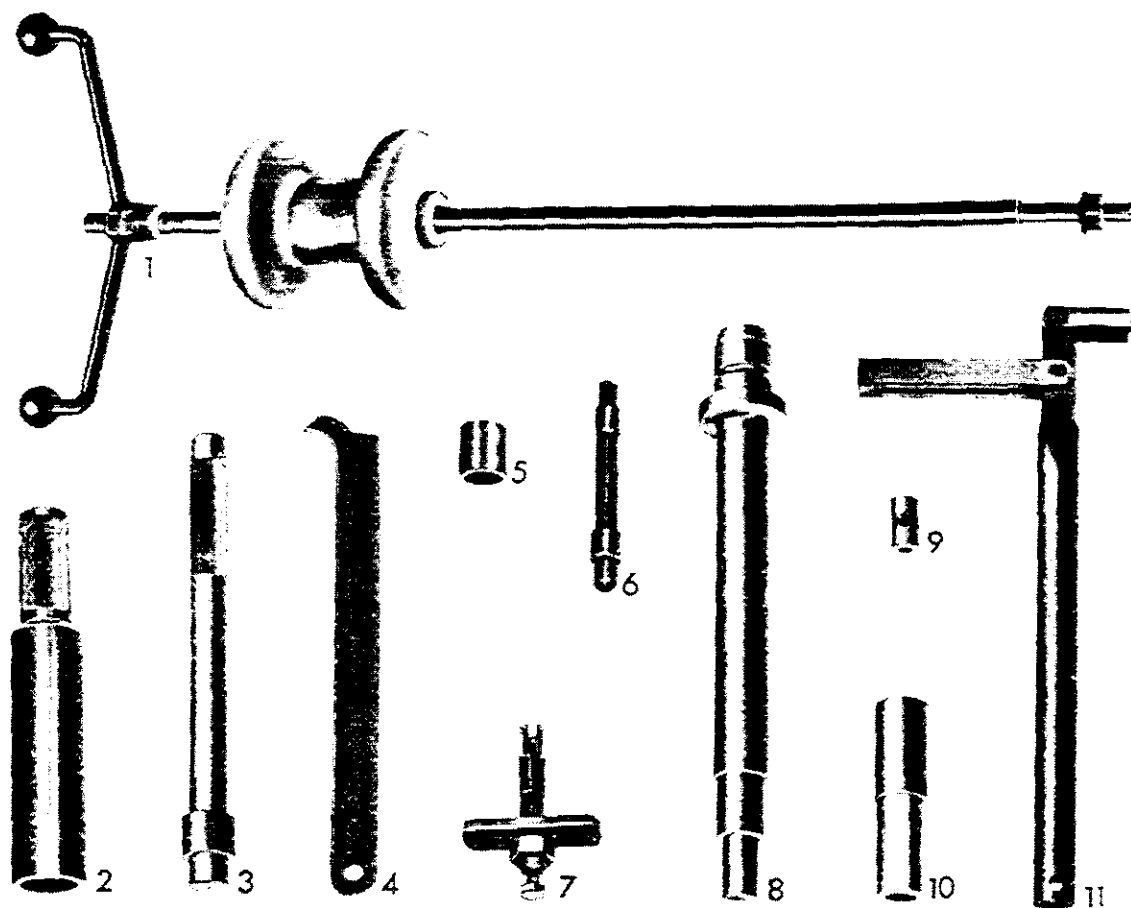
new installation: 1.0—1.9 mm (0.04—0.075 in.)
wear limit: 0.6 mm (0.024 in.)

Assembling

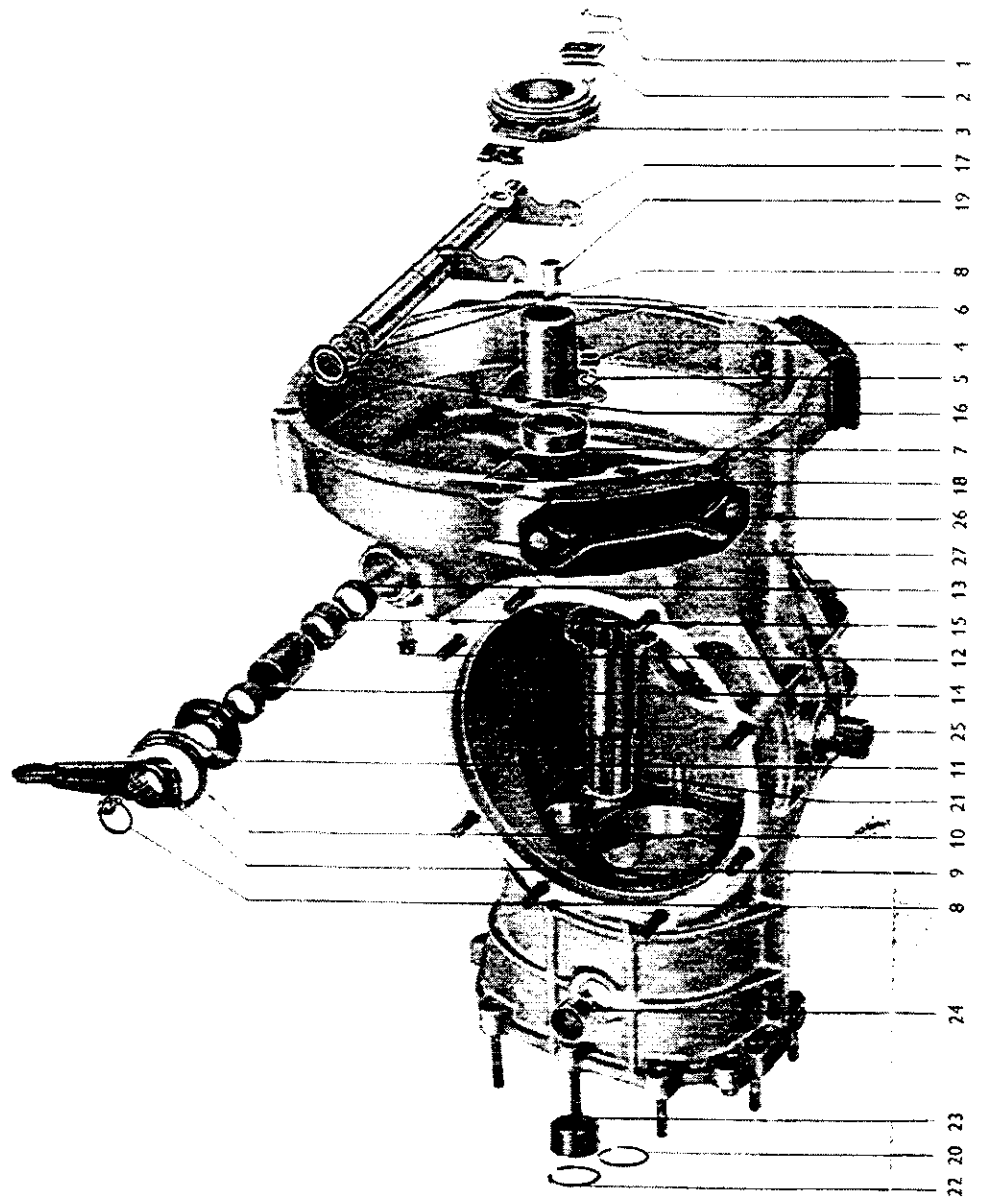
Operating sleeve and synchronizer hub are not matched together and therefore must not be replaced as a set.

To obtain the best possible sliding characteristics and minimum amount of backlash, slide sleeve on hub and check

- a* - that the two parts slide easily; and
- b* - that there is no backlash.



No.	Description	Special Tool No.	Remarks
1	Slide hammer	VW 771	
2	Driving sleeve	VW 244 b	
3	Removal tool	VW 295	
4	Removing bar	VW 681	
5	Thrust tube	VW 520	
6	Starter bushing drift	VW 222 a	
7	Starter bushing puller	VW 228 b	
8	Punch	VW 408 a	
9	Removing tool	VW 771/15	
10	Thrust tube	VW 421	
11	Removal tool	VW 296	modified



No.	Description	Qty.	Note when disassembling	Note when assembling	Special instructions see
1	Spring	2			
2	Spring retainer	2			
3	Release bearing	1		do not wash out, coat Teflon surface with Molykote	
4	Nut M 7	3			
5	Lock washer	3			
6	Centering sleeve	1		remove to replace oil seal	
7	Oil seal, drive shaft	1	use VW 681	drive in with VW 244 b	Fig. 1 Fig. 9
8	Circlip	2			
9	Clutch lever	1			
10	Return spring	1			
11	Spring locating collar	1			
12	Lock bolt	1		14.2 mm (0.559 in.) long	
13	Bushing	2			
14	Sleeve	1			
15	Bushing	1			
16	Washer	1			
17	Clutch operating shaft	1			
18	Bushing, operating shaft	1	use VW 771, VW 771/15 and puller	drive in with VW 408	Fig. 2 Fig. 8
19	Bushing, starter shaft	1	pull out with VW 228 b	drive in with 222 a	Fig. 3 Fig. 7
20	Circlip, reverse gear shaft	1			
21	Reverse gear shaft, assembly	1	drive out with plastic hammer	press in with VW 296	Fig. 5
22	Circlip, needle bearing	1			
23	Needle bearing, main drive shaft	1	press out with VW 295 and VW 421	drive in with VW 295 and VW 520	Fig. 4 Fig. 6
24	Oil fill plug	1			
25	Oil drain plug	1			
26	Banded rubber mounting	2			
27	Transmission case	1			

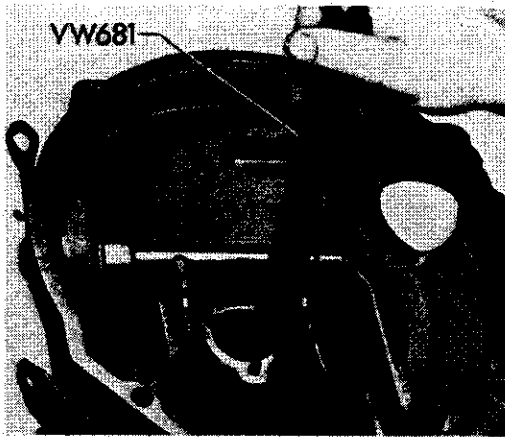
Disassembling

Fig. 1

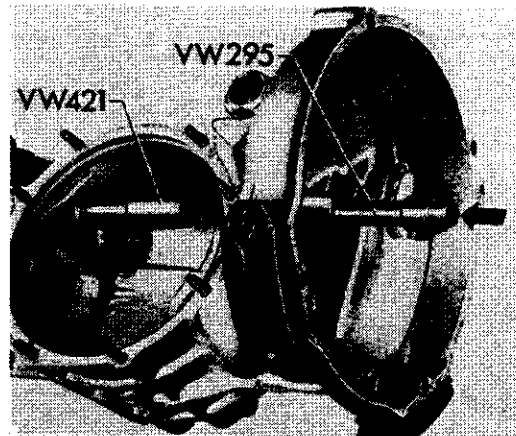


Fig. 4

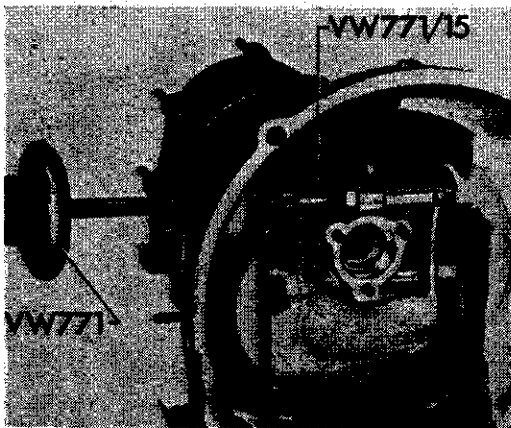


Fig. 2

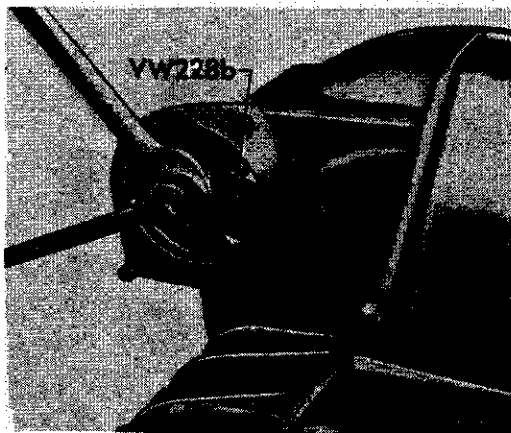


Fig. 3

Assembling

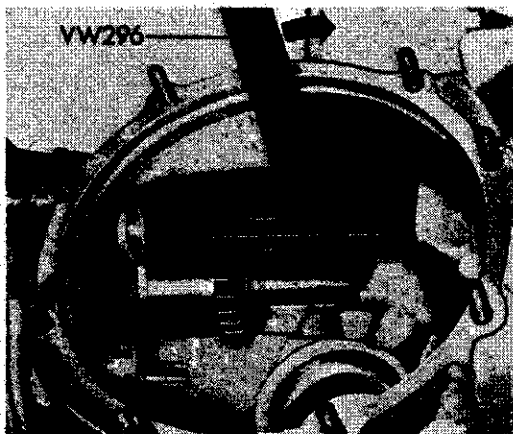


Fig. 5

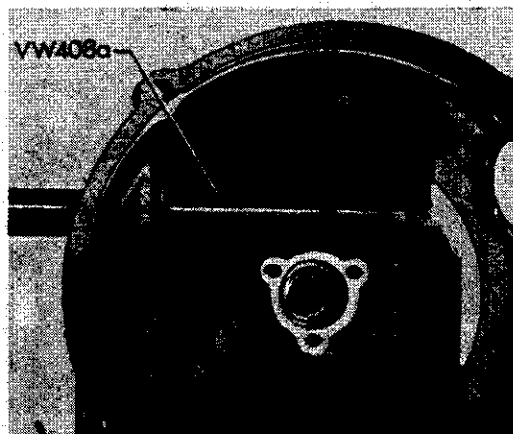


Fig. 8

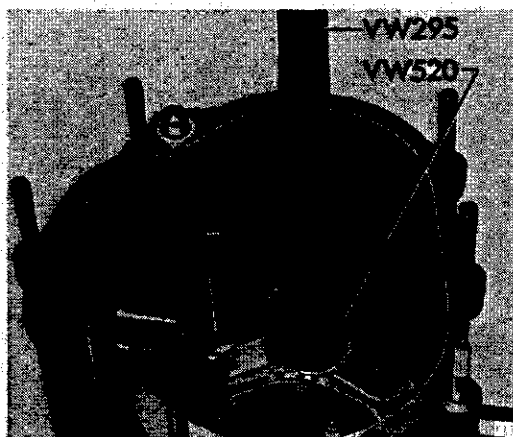


Fig. 6

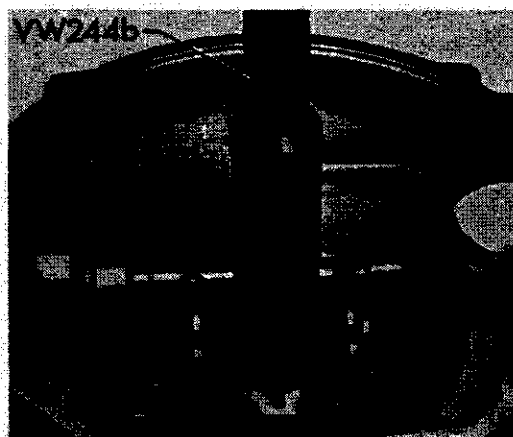


Fig. 9

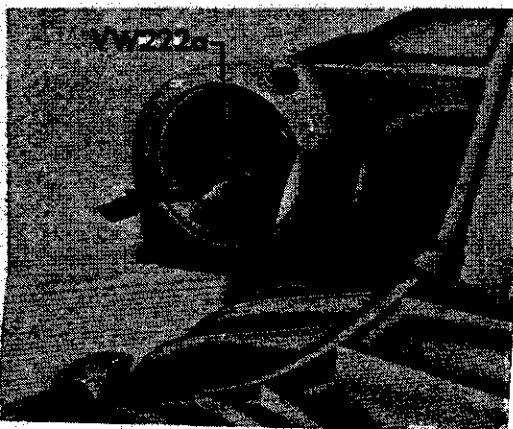
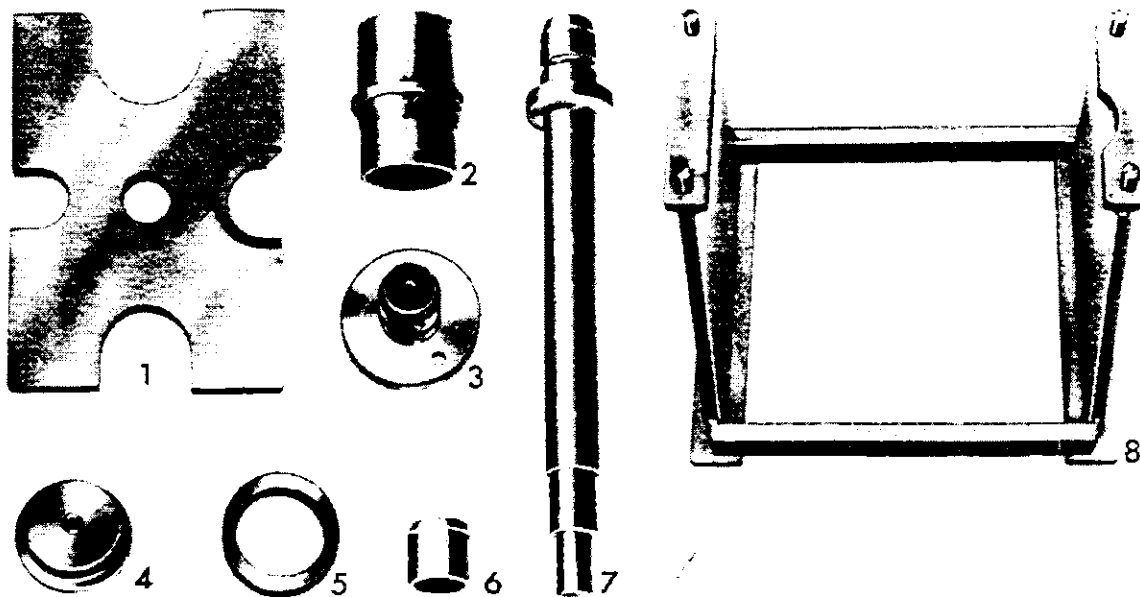
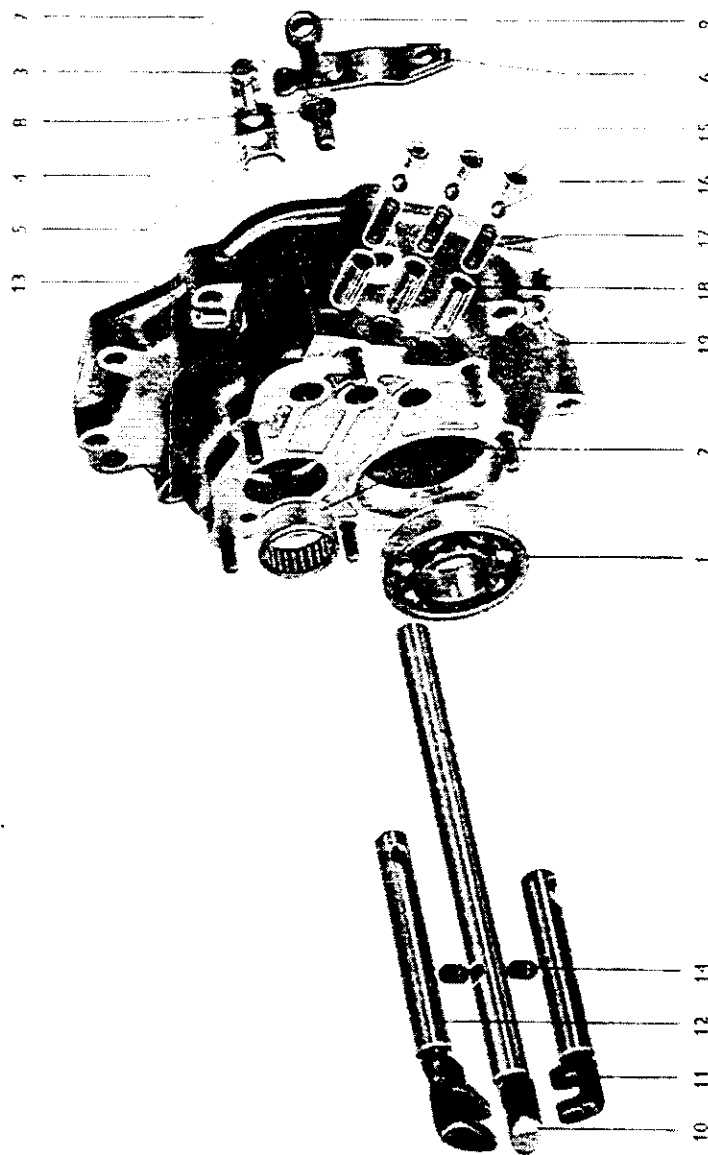


Fig. 7



No.	Description	Special Tool	Remarks
1	Thrust plate	VW 401	
2	Thrust piece	VW 473	
3	Thrust disc	VW 412	
4	Thrust plate	VW 447 i	
5	Thrust ring	VW 429	
6	Thrust piece	VW 463 4	
7	Punch	VW 408 α	
8	Support	VW 456	



No.	Description	Qty.	Note when disassembling	Note when assembling	Special instructions see
1	Bearing, drive shaft	1	press out with VW 401, VW 408 a and VW 473	press in with VW 401, VW 429, VW 447 i, VW 456	Fig. 1 Fig. 6
2	Needle bearing, drive pinion	1	press out with VW 408 and VW 463 4	press in with VW 412, VW 456 and VW 463 4	Fig. 2 Fig. 7
3	Bolt	1		tighten to 2.0 mkg (14 lb ft)	
4	Retaining washer	1			
5	Guide plate	1			
6	Relay lever	1			
7	Nut M 10	1		tighten to 3.5 mkg (25 lb ft)	
8	Spring washer B 10	1			
9	Support, relay lever	1		adjust	Fig. 5
10	Selector shaft, 1st and 2nd gear	1		force required to overcome the detent ball 15—20 kg (33—44 lbs)	Fig. 4
11	Selector shaft, 3rd and 4th gear	1		force required to overcome the detent ball 15—20 kg (33—44 lbs)	Fig. 4
12	Selector shaft, reverse gear	1		force required to overcome the detent ball 15—20 kg (33—44 lbs)	Fig. 4
13	Plug	1	cut thread, pull out with a bolt	press in	Fig. 3
14	Interlock plunger	2		check operation of plungers by engaging a gear, the adjacent selector shaft must be blocked	
15	Plug	3	cut thread, pull out with a bolt	press in	Fig. 3
16	Ball, detent	3		press down with screw- driver before installing selector shaft	
17	Spring, detent	3		23—25 mm (0.905—0.984 in.) unloaded	
18	Slotted bushing	3			
19	Gear carrier	1			

Disassembling

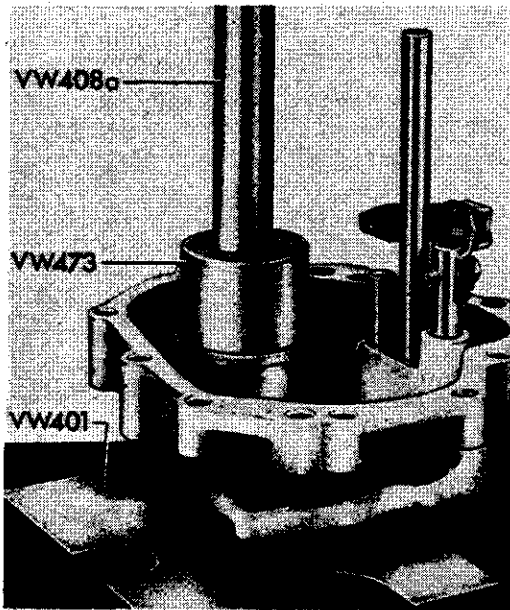


Fig. 1

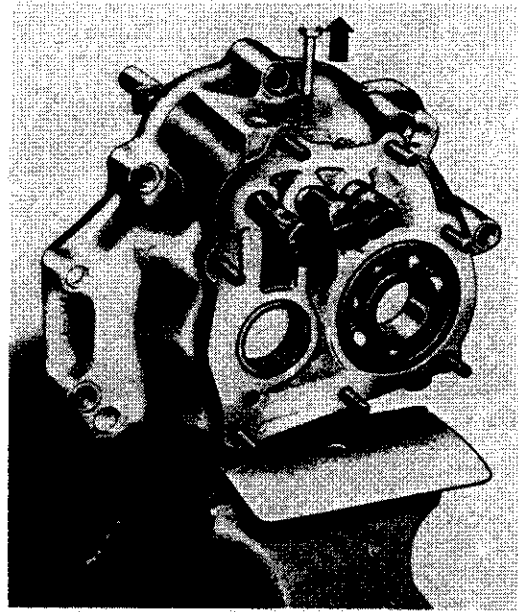


Fig. 3

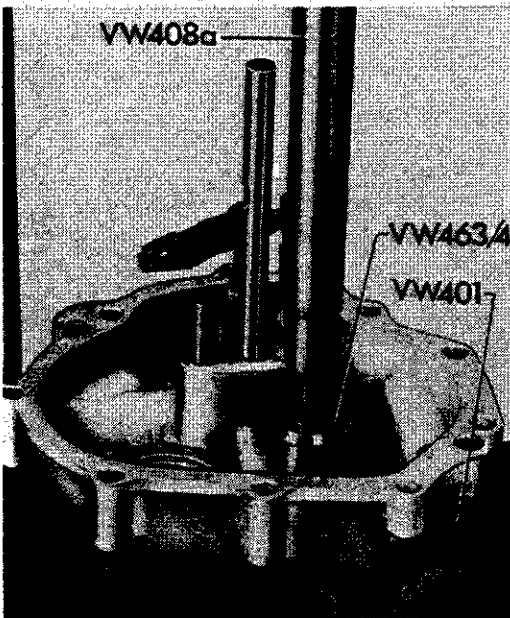


Fig. 2

Assembling

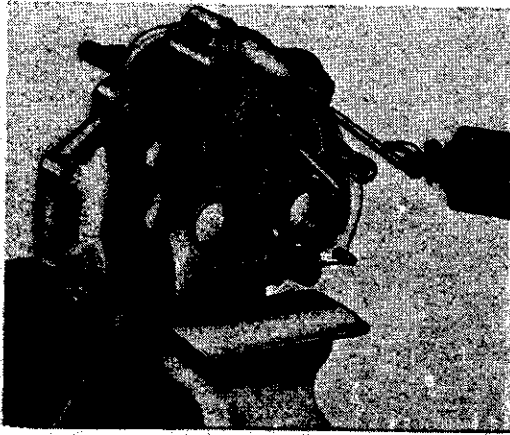


Fig. 4

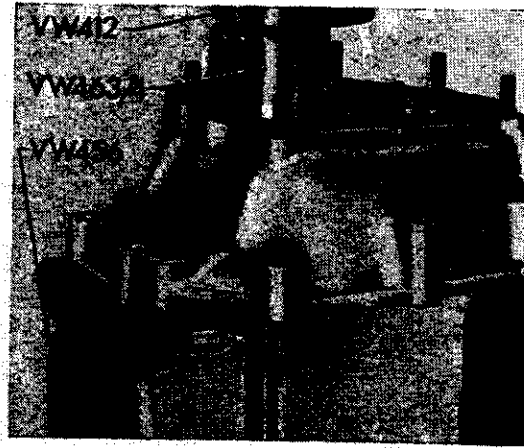


Fig. 7

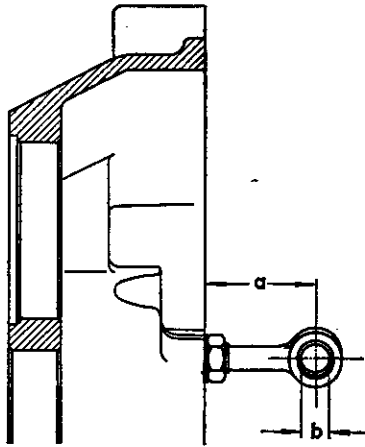


Fig. 5

$a = 43,4 \pm 0,4 \text{ mm (1.707} \pm 0.015 \text{ in.)}$
 $b = 10,0 \text{ mm (0.393 in.)}$

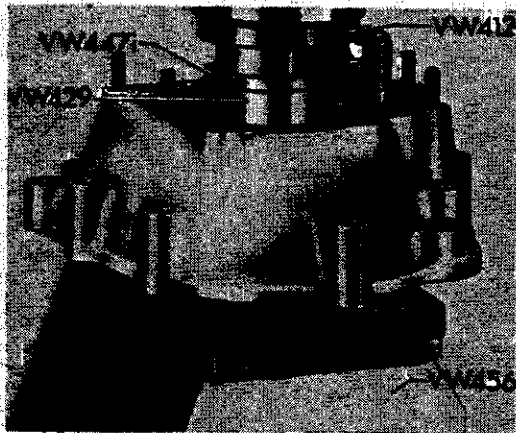
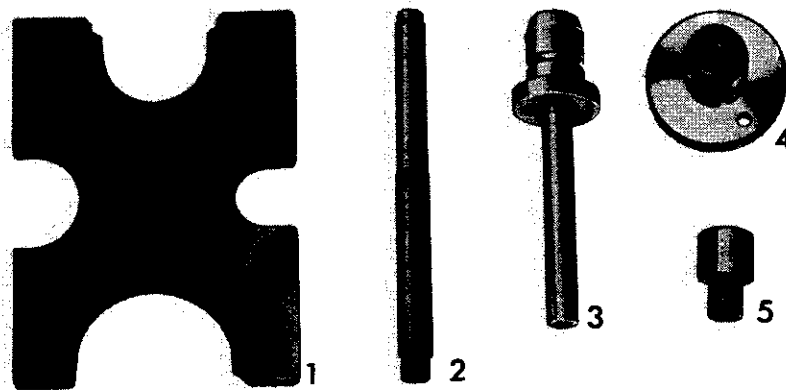
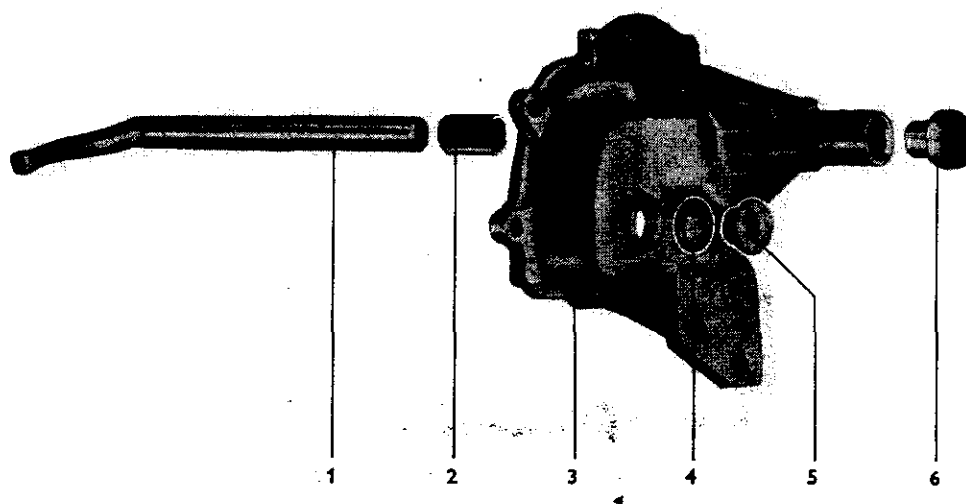


Fig. 6



No.	Description	Special Tool	Remarks
1	Thrust plate	VW 402	
2	Guide pin (shouldered)	VW 439	
3	Punch	VW 411	
4	Thrust disc	VW 412	
5	Thrust pad	VW 431	



No.	Description	Qty.	disassembling	Note when assembling	Special instructions see
1	Inner shift lever	1		coat with transmission oil when installing	
2	Bushing	1		press in with VW 412 and VW 439	Fig. 3
3	Shift housing	1			
4	Sealing washer	1			
5	Plug	1		tighten to 2.5 mkg (18 lb ft)	
6	Bushing with seal	1	twist out with water-pump pliers	press in with VW 402, VW 411 and VW 431	Fig. 1 Fig. 2

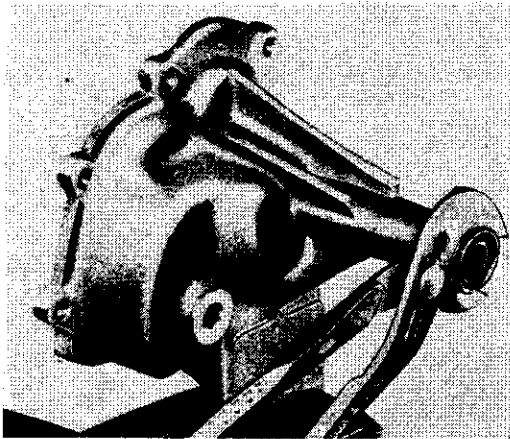
Disassembling

Fig. 1

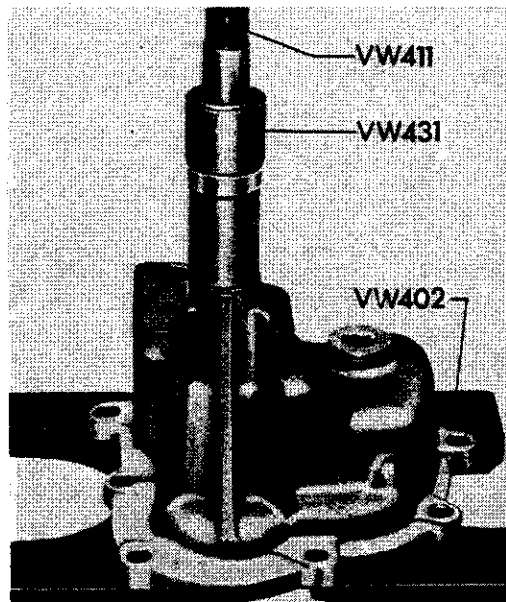
Assembling

Fig. 2

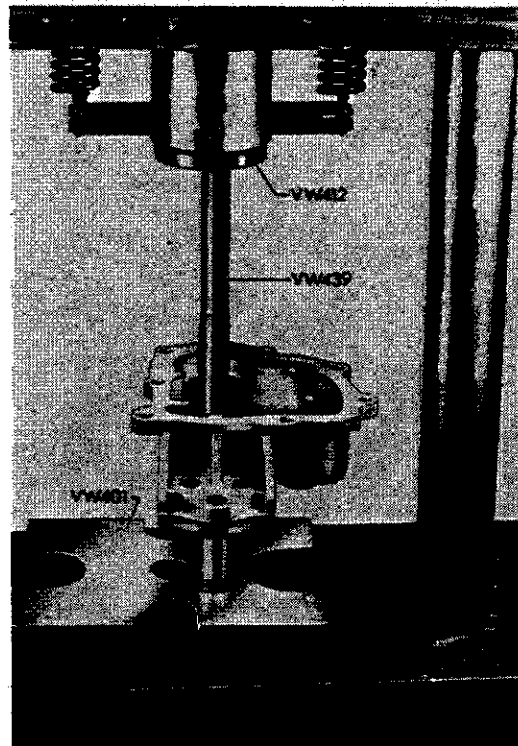
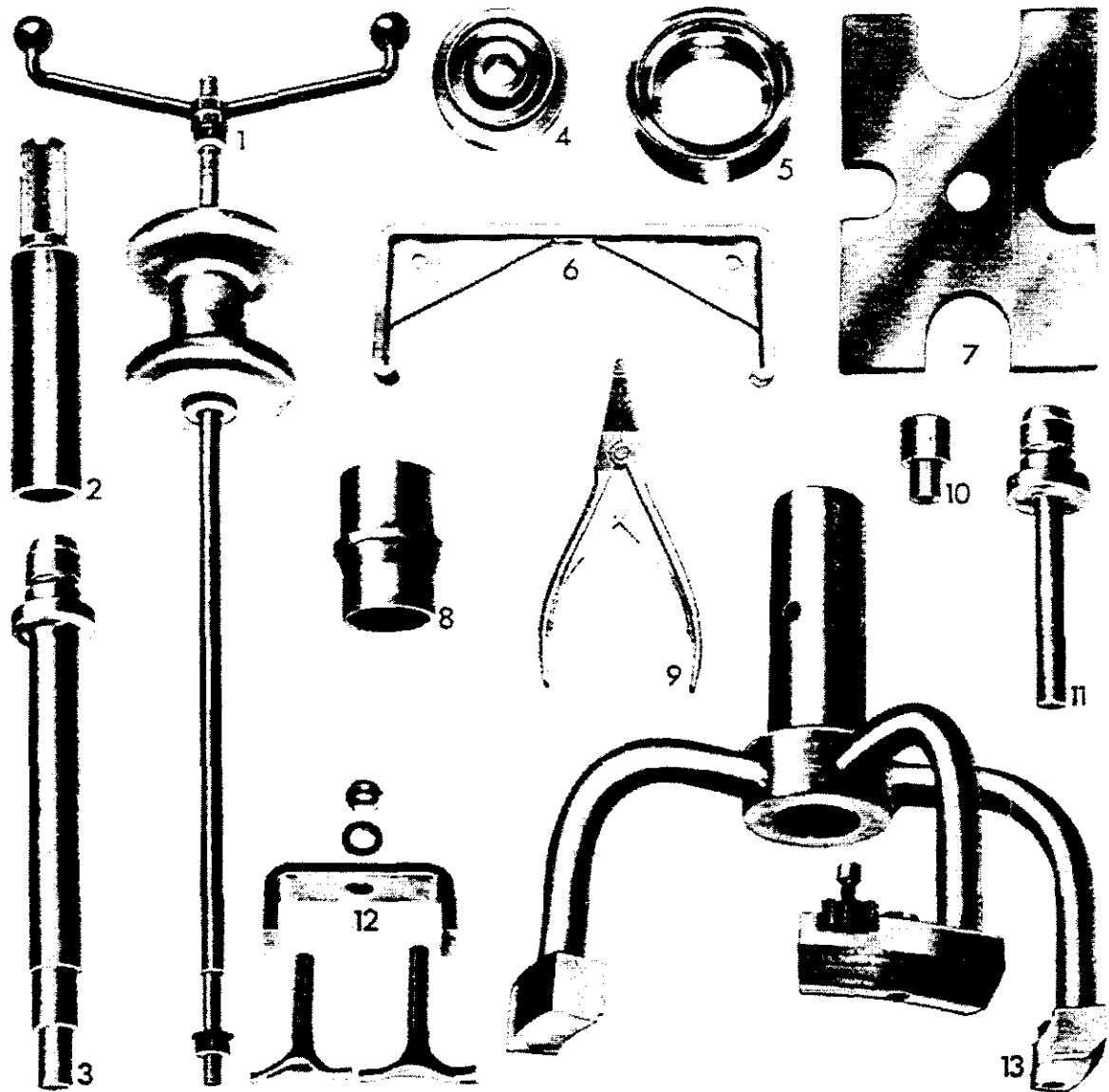
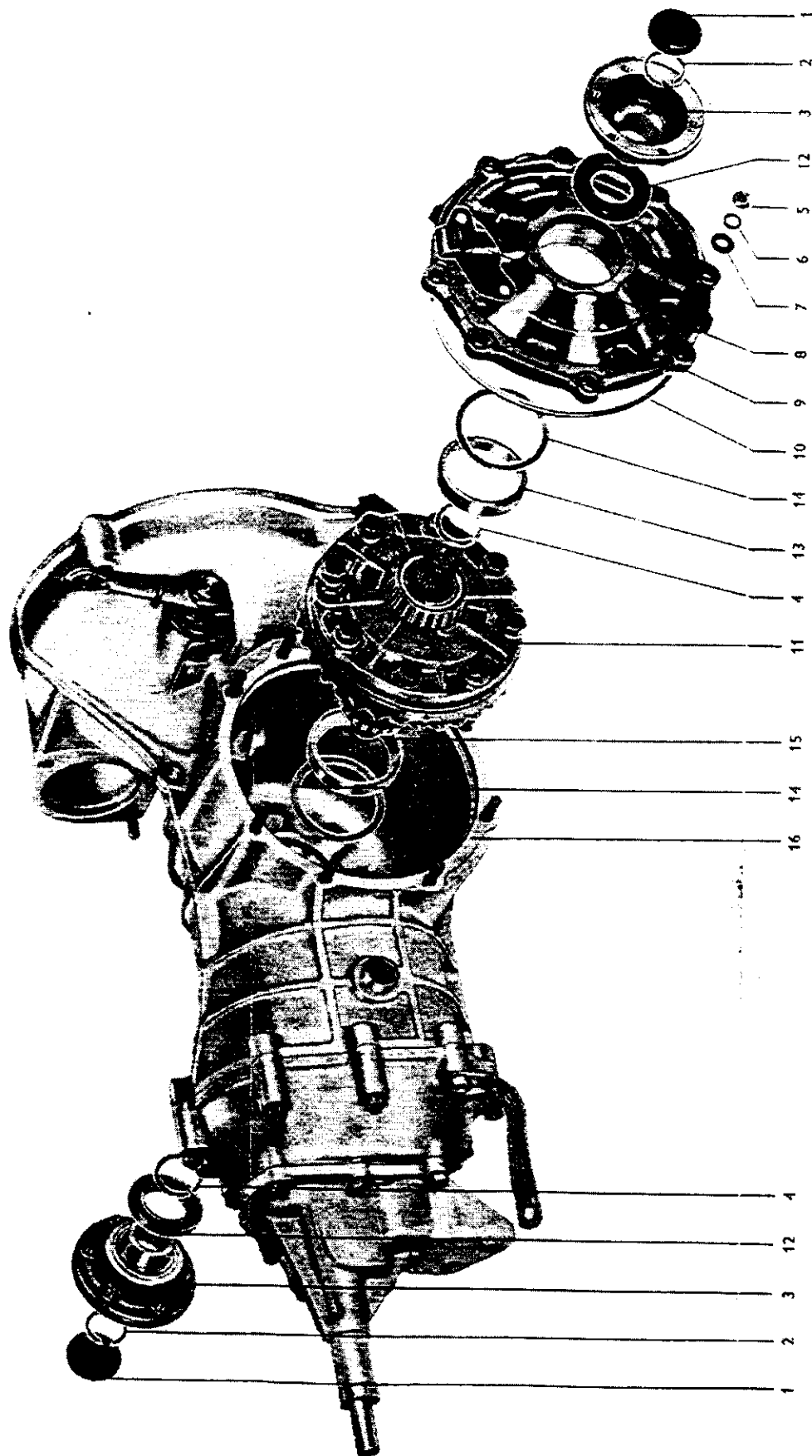


Fig. 3



No.	Description	Special Tool	Remarks
1	Slide hammer	VW 771	
2	Driving sleeve	VW 244 b	
3	Punch	VW 408 a	
4	Thrust pad	VW 442	
5	Thrust ring	VW 459.1	
6	Multi-purpose tool	VW 771/22	
7	Thrust plate	VW 401	
8	Thrust piece	VW 473	
9	Circlip pliers	—	flat nose
10	Thrust pad	VW 431	
11	Punch	VW 411	
12	Oil pump extractor	VW 201	(set of 3)
13	Holding fixture	VW 307 a	



No.	Description	Qty.	removing	Note when installing	Special instructions
1	Cap	2	pierce with a screw driver and pry it out	drive in with VW 244b	Fig. 7
2	Circlip	2		remove the differential side gear and press the flange down on the same time with puller VW 201 and on M 10 bolt to squeeze the wavy spacer washer together until the circlip fits properly in groove.	Fig. 6
3	Flange	2	pry off		Fig. 1
4	Spacer ring	2		replace if play at flange	
5	Nut M 8	8		tighten to 3 mkg (22 lb ft)	
6	Spring washer	8			
7	Washer	8			
8	Bracket	1			
9	Cover, final drive	1	pull off with VW 771 and VW 771/22		Fig. 2
10	O-ring	1		replace	
11	Differential, assembly	1			5.1/5
12	Oil seal	2	pry out	press in with VW 401, VW 408a and VW 442	Fig. 5
13	Outer race, tapered roller bearing	2		press out VW 401, VW 411, VW 431, VW 459/1 and VW 473	Fig. 3
14	Shim "S ₁ "	x		note thickness (do not interchange with "S ₂ ")	H 5.1/12
15	Shim "S ₂ "	x		note thickness (do not interchange with "S ₁ ")	H 5.1/12
16	Transmission case	1			



Removing

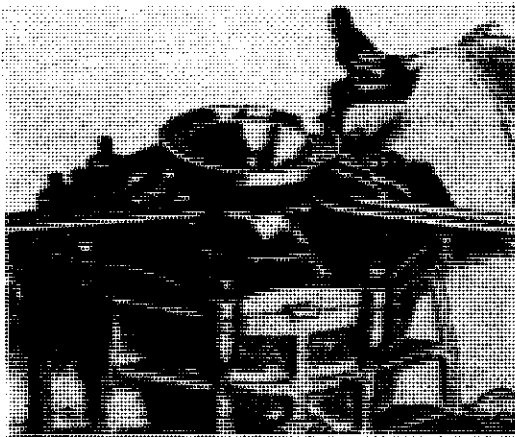


Fig. 1

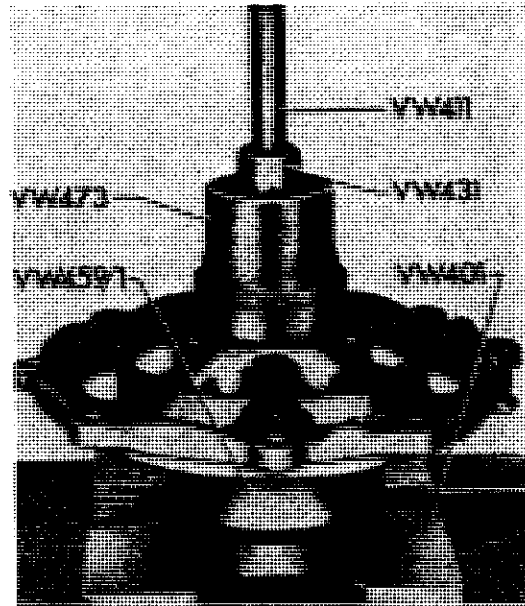


Fig. 3

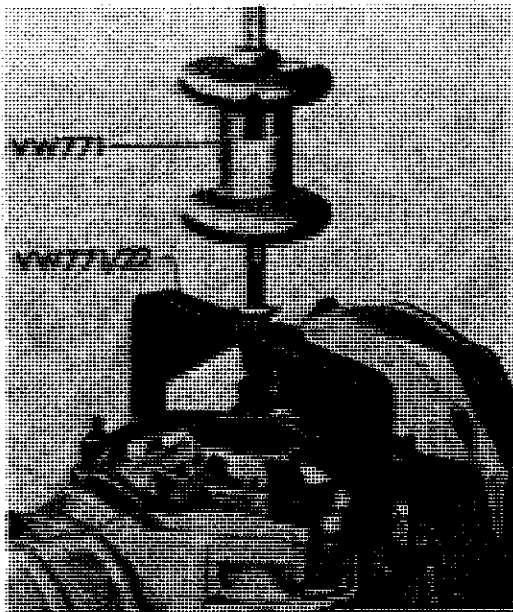


Fig. 2

Removing

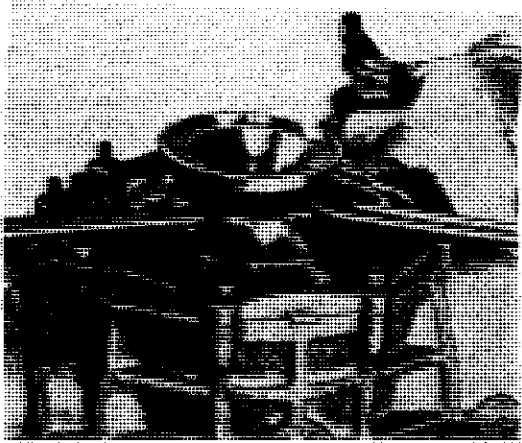


Fig. 1

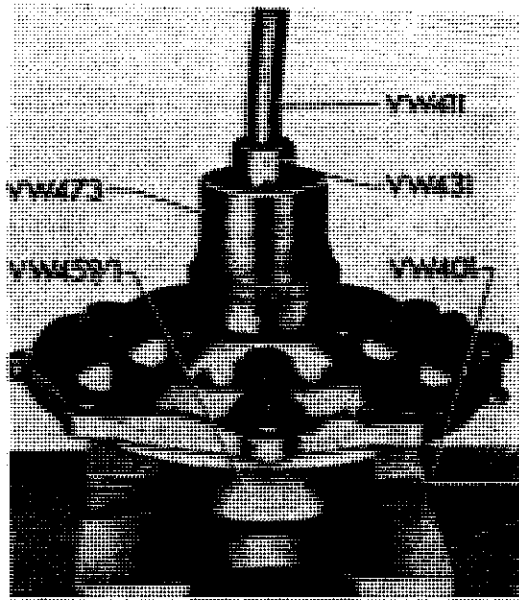


Fig. 3

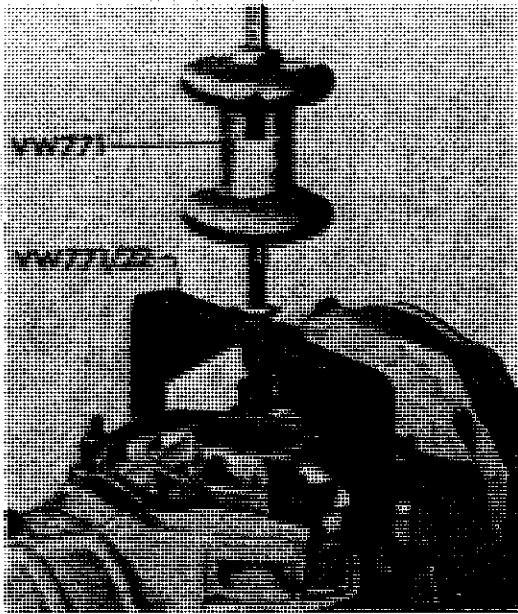
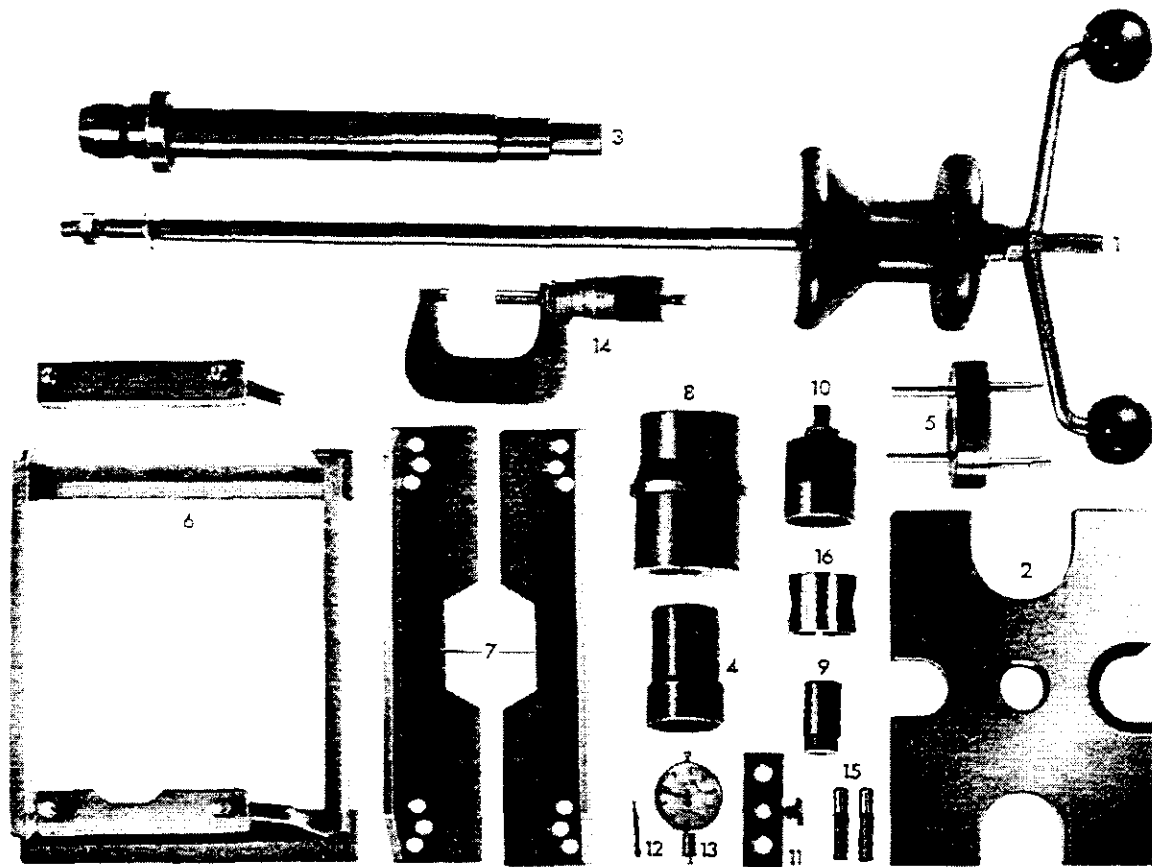
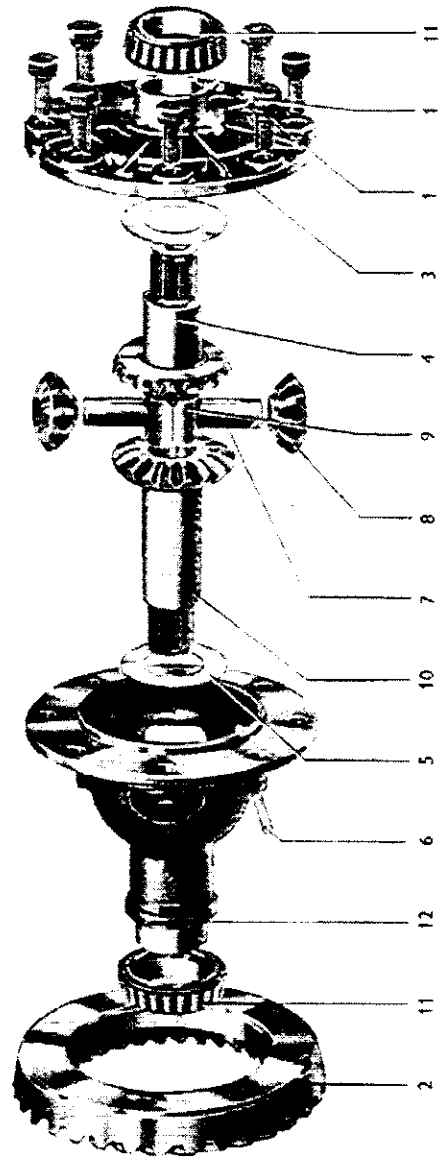


Fig. 2

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No.	Description	Special Tool	Remarks
1	Multi-purpose tool	VW 771	
2	Plate	VW 401	
3	Punch	VW 408 a	
4	Punch	VW 454	
5	Punch	VW 458	
6	Support	VW 456	
7	Support bars	VW 457:1-2	
8	Punch	VW 473	
9	Punch	VW 434	
10	Clamping sleeve	VW 382:3	
11	Measuring bar	VW 383:8	
12	Dial indicator extension	VW 299:3	28 mm long
13	Dial indicator	—	range 3 mm
14	Micrometer	—	range 25—50 mm
15	Centering pins M 9 x 1	—	
16	Measuring sleeve	—	



No.	Description	Qty.	Note when disassembling	assembling	Special instructions see
1	Bolt with spring washer	8		tighten cross-wise to 6 mkg (43 lb ft), use VW-genuine bolts and spring washers only.	
2	Ring gear	1	drive off with punch	heat to 100 °C (212 °F) and use centering pins	Fig. 1 Fig. 9
3	Cover for differential housing	1	pull off with VW 771	check and/or adjust axial play	Fig. 2 5.1/12-5
4	Differential gear, (short shaft)	1		check for wear, check and/or adjust axial play	5.1/12-5
5	Thrust washer	2		check for wear, check and/or adjust axial play	5.1/12-5
6	Pin for shaft	1	drive out with punch	peen at both ends with center punch	Fig. 8
7	Shaft, differential pinions	1	drive out with punch		Fig. 3
8	Differential pinion	2		check for wear	
9	Spacer sleeve	1		measure sleeve before installing	5.1/12-5
10	Differential gear, (long shaft)	1		check for wear and/or axial play	5.1/12-5
11	Tapered roller bearing, inner race	2	press with VW 401, VW 408 a; VW 454 and VW 458 off cover and with VW 454, VW 457/1 and VW 457/2 off differential housing	heat to 100 °C (212 °F) and press in position; using VW 401, VW 454 and VW 473	Fig. 4 Fig. 5 Fig. 6 Fig. 7
12	Differential housing	1		check thrust faces for wear	5.1/12-5

Disassembling

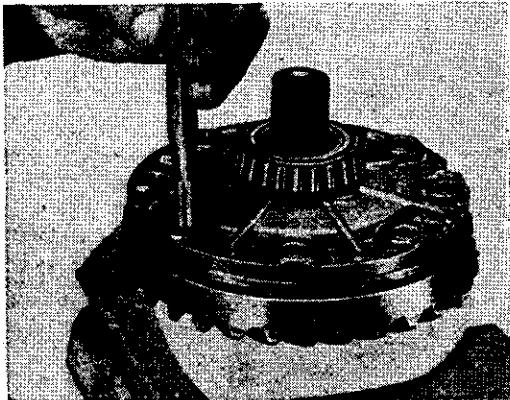


Fig. 1



Fig. 2

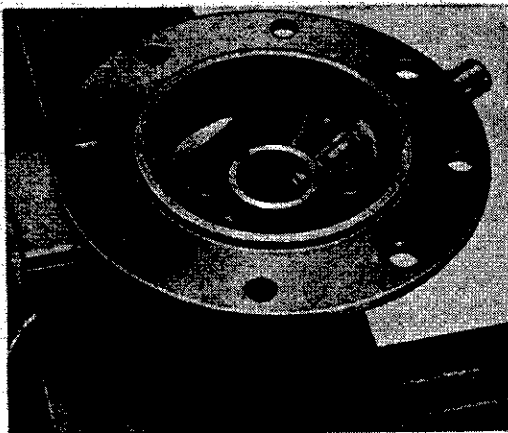


Fig. 3

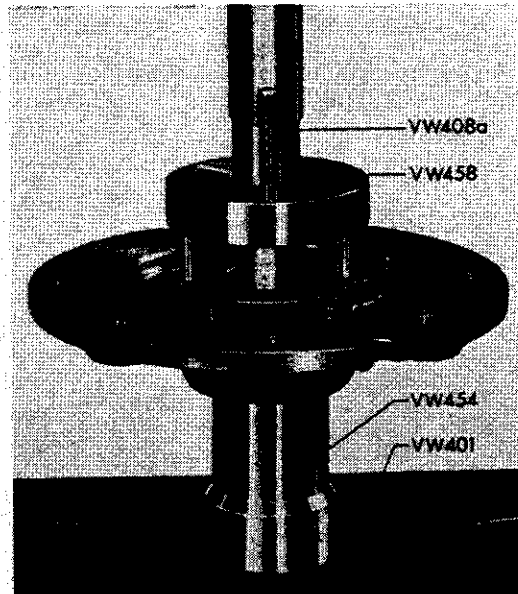


Fig. 4



Fig. 5

Assembling



Fig. 6



Fig. 8



Fig. 7

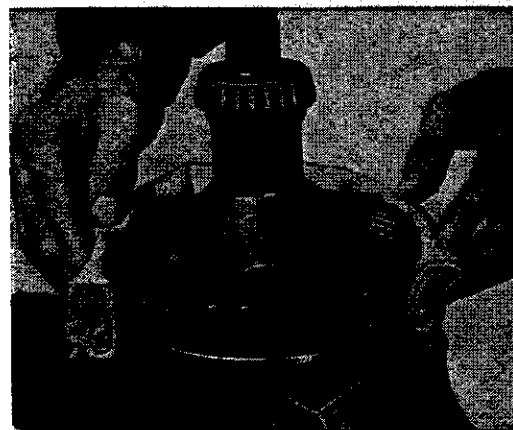
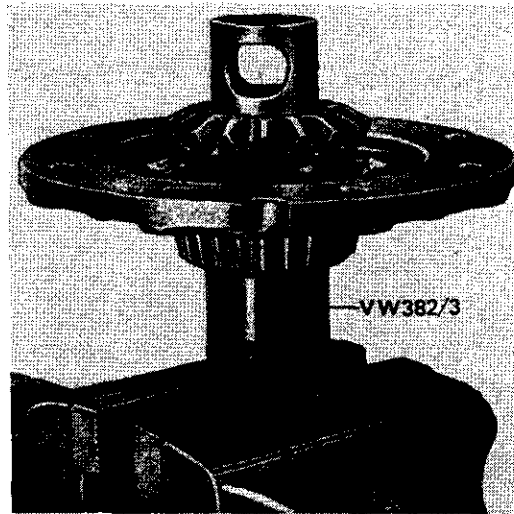


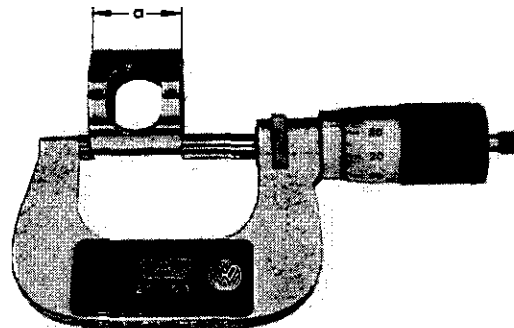
Fig. 9

The spacer sleeve ensures that the backlash between the bevel gears is adequate even when there is axial pressure on the differential side gears. If the housing, the cover, one of the side gears or the spacer sleeve are replaced, the length of the spacer sleeve must be determined again.

- 1 - Place side gear (short shaft) and **both** thrust washers in the differential cover, attach clamping sleeve VW 382/3 and clamp bevel gear tightly against the cover.



- 2 - Place side gear (long shaft) in the differential housing.
Measure the shortest spacer sleeve — Part No. 004 517 241 — with a micrometer and mark the size on the sleeve with an electrical marker or similar device. This sleeve should then always be used as a measuring sleeve and kept together with the measuring appliance.

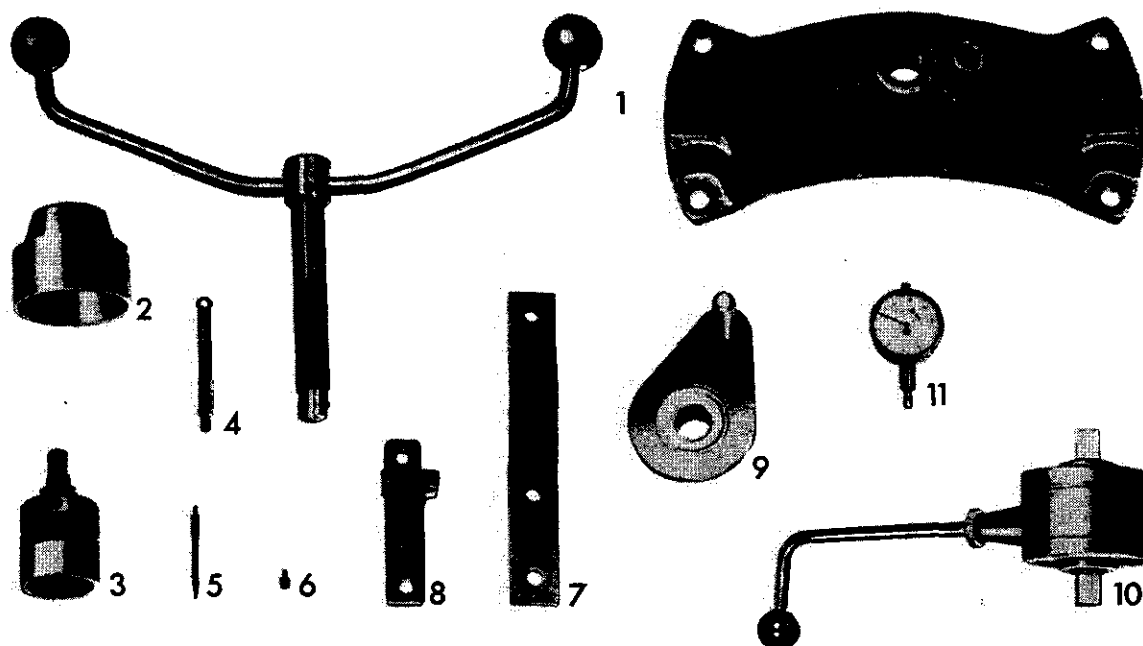


- 3 - Insert sleeve and mount cover to housing with four M 8 x 20 screws, use washers on the ring gear side.
- 4 - Attach measuring bar VW 383/8 with dial indicator and 28 mm extension (VW 299/3) to the end face of the side gear with an M 10 bolt. The dial indicator extension must contact the edge of the housing neck.
- 5 - Ascertain axial play by moving the side gear up and down.
- 6 - Add play measurement to sleeve length. Look up result in table under "x"-range column.
Entries on same line in other column give sleeve length "l" and part number.

"x"-range	Sleeve length "l"	Part No. of sleeve
28.82—28.90	28.85	004 517 241
28.91—28.99	28.94	004 517 242
29.00—29.08	29.03	004 517 243
29.09—29.18	29.12	004 517 244

- 7 - Take differential apart, remove measuring sleeve, fit correct sleeve as determined, assemble differential again without shaft and recheck the play. If the sleeve has been selected correctly, the axial play, with differential assembled, should be
between 0 mm and 0.14 mm.

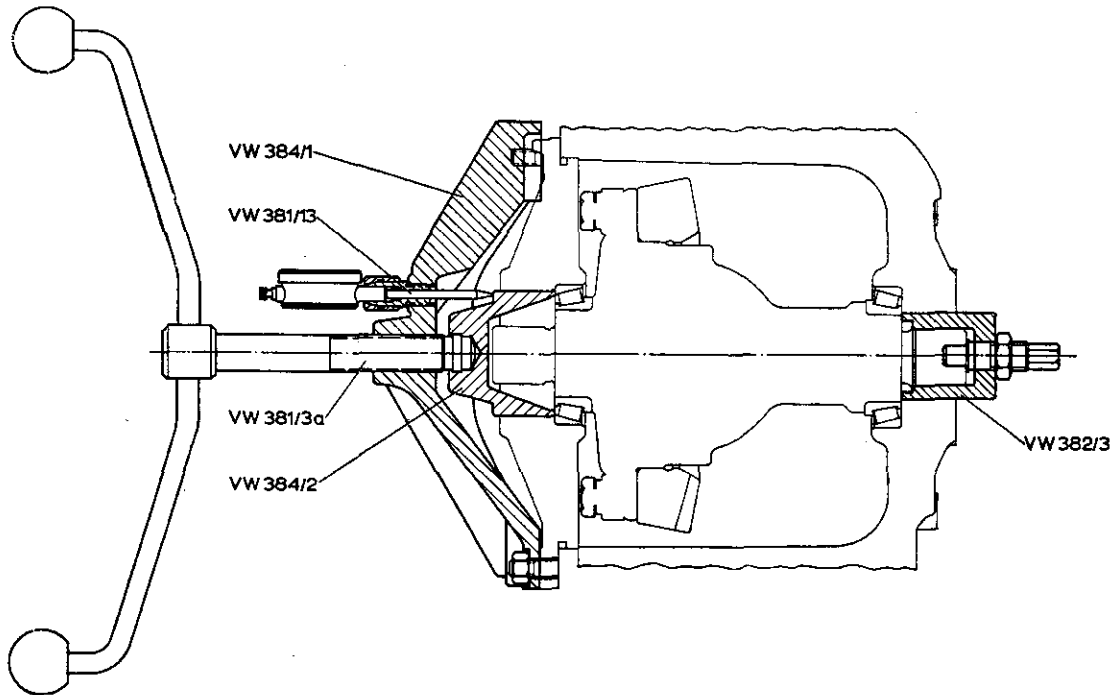




No.	Description	Special Tool	Remarks
1	Setting appliance, rear axle	VW 384/1	
2	Adapler	VW 384/2	
3	Clamping sleeve	VW 382/3	
4	Measuring lever	VW 382/4	
5	Extension (52 mm)	VW 381/13	
6	Extension 6 mm (flat end)	VW 382/10	
7	Pinion retaining bracket	VW 381/11	
8	Indicator bracket	VW 384/3	
9	Crank handle	VW 294 b	
10	Torque gauge	—	0—30 cmkg
11	Dial indicator	—	3 mm range

When adjusting the ring gear and drive pinion always proceed in the following sequence:

- A - Measure " S_{total} " — tapered roller bearings preload — (H 5.1/13)
- B - Check drive pinion adjustment (H 5.1/14)
- C - Check ring gear adjustment — backlash — (H 5.1/15)



- A - Determine thickness of shim " S " — tapered roller bearings preload — (drive pinion removed)

The ring gear only needs adjusting if parts replaced have a direct influence on the adjustment of the ring gear.

These parts are: gear set, transmission case, differential housing, differential housing cover, final drive covers or tapered roller bearings. Care and cleanliness are essential to ensure satisfactory results.

- 1 - Remove oil seals and outer race of tapered roller bearings. Take out shims " S_1 " and " S_2 " and press outer race of tapered roller bearings back into housing and cover (H 5.1/11).
- 2 - Place differential in transmission case. The ring gear must be on the left side.

Caution

Before installing differential, oil the bearings with hypoid transmission oil. Bearings which are dry or have been lubricated with other oils will give incorrect results.

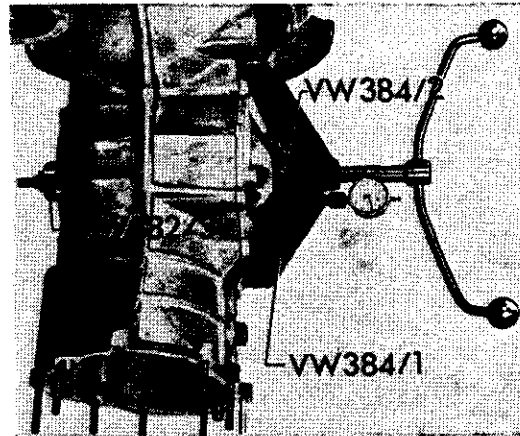
- 3 - Install cover on transmission case. Place setting appliance VW 384/1 and 384/2 on cover and tighten nuts diagonally to correct torque.

Note

It is advisable to remove the O-rings when carrying out the adjustment.

- 4 - Fit clamping sleeve VW 382/3 opposite the ring gear side without lever VW 382/4.

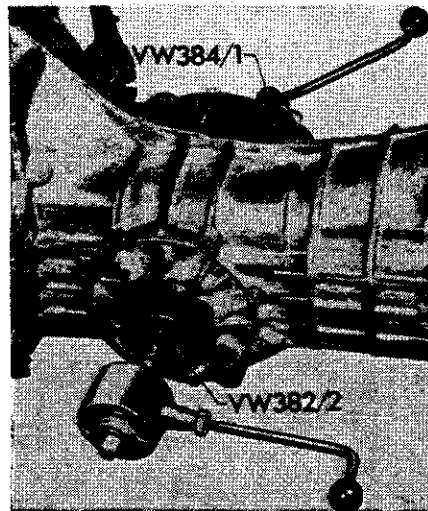
- 5 - Turn transmission so that the ring gear is at the bottom. Turn the spindle of the **setting appliance VW 384/1** carefully until the thrust piece is just touching the bearing outer race without play. Take care that the bearing race is not moved at this stage.
- 6 - Install **dial indicator with extension VW 381/13 (52 mm)** in the **VW 384/1 appliance** and zero indicator with 3 mm preload.
- 7 - Press the bearing outer race in by turning the spindle until there is no detectable play in the differential bearings.



- 8 - Turn transmission 90°. Place **torque gauge with a 10 mm socket on the clamping sleeve VW 382/3** and turn differential in **both directions** several times.
- 9 - Tighten spindle to increase the pressure on the bearings until the required preload (turning torque) is obtained.

Note

Increase the torque very slowly and check the reading several times while doing so. If the specified torque is exceeded, the side cover must be removed, the bearing race pressed back to the original position again and the adjustment repeated.

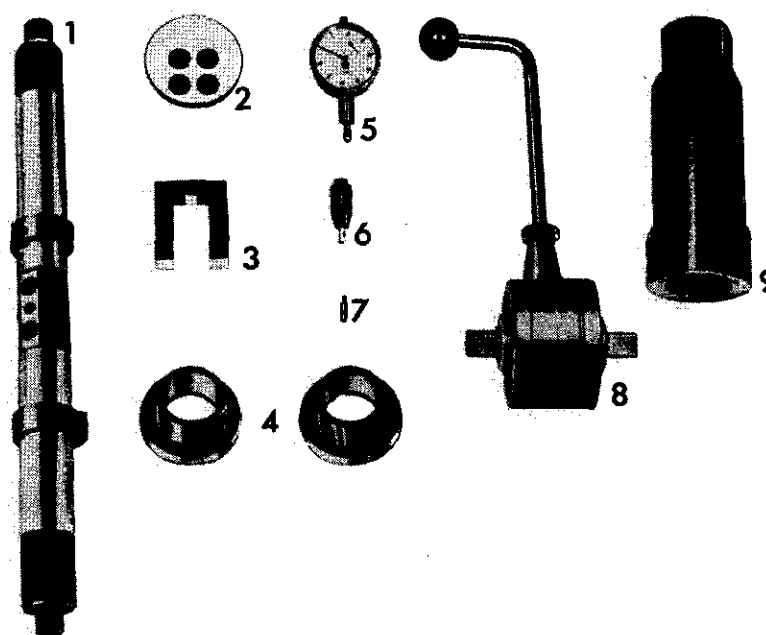


The turning torque should be as follows:

new bearings	used bearings*
30—35 cmkg (27—31 in. lb)	3—7 cmkg (3—6 in. lb)

* used more than 30 miles

- 10 - Take dial indicator reading (red figures). This figure should be noted as the dimension for the total shim thickness "S". It can be from 0.95—2.10 mm.
Example: "S_{total}" = 1.65 mm.
- 11 - Remove cover and differential. Press bearing race until fully seated again in right cover.
- 12 - Install transmission with the shim "S_s" as determined (see Adjusting drive pinion — H 5.1/14).



No.	Description	Special Tool	Remarks
1	Universal measuring bar	VW 385/1	
2	Measuring plate	VW 385/17	
3	Setting gauge	VW 385/9	
4	Centering disc (2)	VW 385/2	
5	Dial indicator	—	range 0—3.0 mm
6	Measuring pin	VW 385/14	
7	Dial indicator extension	VW 385/15	
8	Torque gauge	—	
9	Socket wrench	VW 293	

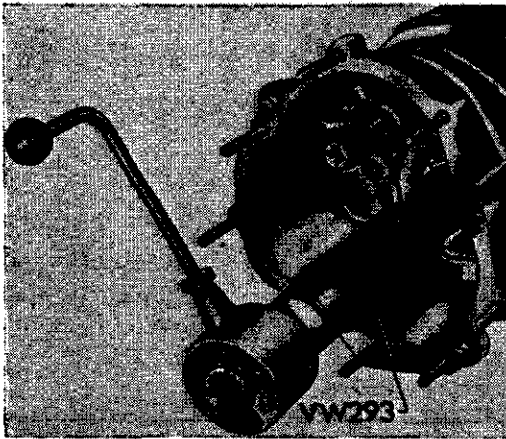
B - Adjust drive pinion

Proceed as described when the drive pinion and ring gear have been replaced. If the double tapered roller bearing and/or the transmission case were replaced proceed as described in H 3.1/8.

- 1 - Assemble drive pinion up to needle bearing for 1st gear. Tighten round nut to correct torque but do not lock it.
- 2 - Place pre-assembled drive pinion in transmission case without shim "S3". Tighten bearing retaining nut to correct torque.

Note

To align the drive pinion in the housing, it is advisable to install the gear carrier.



Measuring preload (turning torque)

- 3 - Check double tapered roller bearing preload, using a torque gauge, adapter VW 293 and 32 mm socket.

Caution

Before installing the drive pinion, lubricate bearings with hypoid oil. If checked dry or lubricated with any other oil, the test results will be inaccurate.

	new bearings	used bearings*)
Turning torque	6—21 cmkg (5—18 in. lb)	3—7 cmkg (3—6 in. lb)

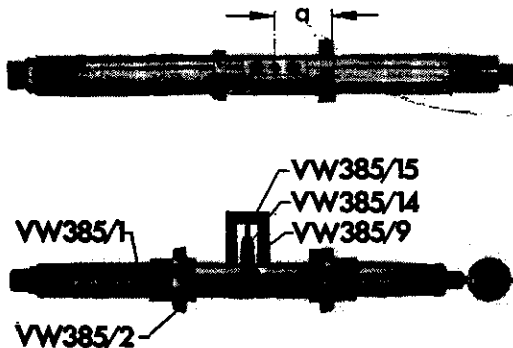
*) Used more than 30 miles

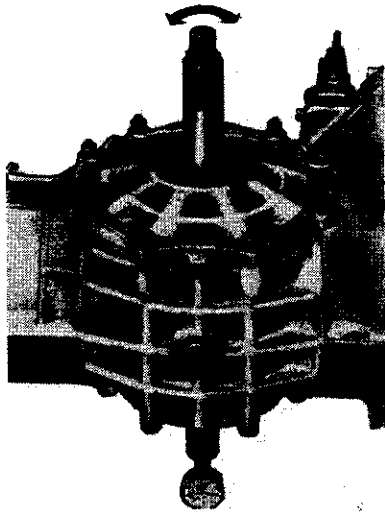
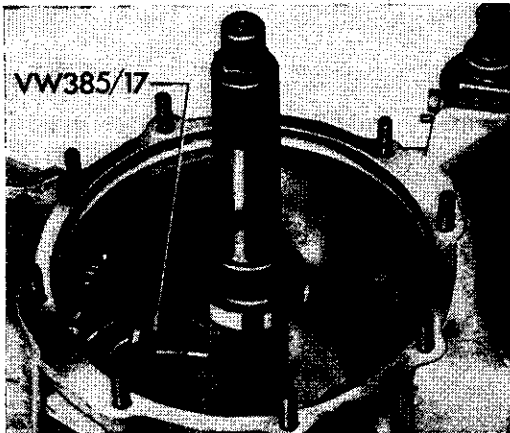
Determine dimension "e"

- 1 - Set the ring on the universal bar VW 385/1 to dimension $a = 70$ mm.
- 2 - Assemble universal measuring bar as shown and place setting gauge VW 385/9 ($R_o = 58.70$ mm) on the bar and zero dial indicator (3 mm range) with 1 mm preload.

Note

Move the sliding ring back to the stop.





- 3 - Attach measuring plate VW 385/17 to end of drive pinion, remove setting gauge from universal measuring bar and place bar in transmission case.

- 4 - Install cover and tighten nuts to correct torque.

- 5 - Push the setting ring of the second centering disc outward until the bar can just be turned by hand.

- 6 - Turn the bar until the dial indicator pin contacts the measuring plate on the drive pinion and the pointer of the dial indicator reaches the return point.

- 7 - Note the reading for dimension "e" and determine thickness of shims using the following formula:

$$S_s \text{ nominal} = e + r$$

For example:

$$\begin{array}{r} e = 0.48 \text{ mm} \\ + r = 0.38 \text{ mm} \\ \hline S_s \text{ nominal} = 0.86 \text{ mm} \end{array}$$

$$\begin{array}{r} .23 \\ + .35 \\ \hline .58 \end{array}$$

Select shim according to table:

Shim thickness	Part No.
0.15	001 311 391
0.20	001 311 392
0.30	001 311 393
0.40	001 311 394
0.50	001 311 395
0.60	001 311 396
0.70	001 311 397
0.80	001 311 398
0.90	001 311 399

- 8 - Install pinion with the measured shim and check the measurement.

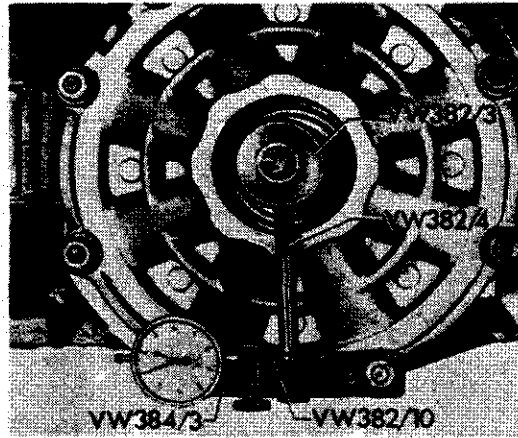
Note

If the "S_s" shim has been selected correctly the dial indicator reading should now show the deviation "r" marked on the drive pinion within a tolerance of ± 0.04 mm.

C - Adjusting backlash

- 1 - Press out tapered roller bearing outer race. Insert shims " S_{total} " (example 1.65 mm) and press outer race back in.
- 2 - Install rear part of drive shaft. Place differential in housing with **clamping sleeve VW 382/3** attached. Install final drive cover. **Mount dial indicator holder VW 384/3**. Tighten nuts diagonally to the correct torque.
- 3 - Attach pinion **retaining bracket VW 381/11** on the gear carrier and tighten nuts by hand.
- 4 - Attach **lever VW 382/4** into **clamping sleeve VW 382/3**. Install **dial indicator** (3 mm range) with **extension VW 382/10** (6 mm) in the dial indicator holder so that edge of the clamping cylinder on the indicator is flush with edge of holder.
- 5 - Turn ring gear with **crank handle VW 294** until the **lever VW 382/4** is touching the dial indicator pin. Then turn carefully until indicator has a **preload of 1.5 mm**.

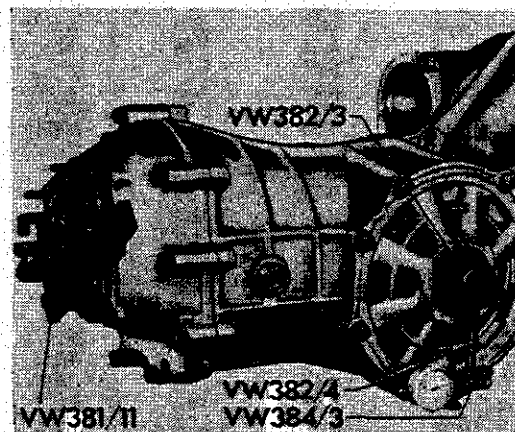
Do not damage the dial indicator.



- 6 - Block pinion in this position with **retaining bracket VW 381/11**.
- 7 - Turn ring gear as far it will go and set dial indicator to zero. Turn ring gear in other direction and read off **backlash " S_{vo} "**. Note the measurement.
- 8 - Loosen lock nut in clamping sleeve on differential and nuts of pinion retaining bracket. Turn ring gear and take three further readings at intervals of 90° . Add the readings together and find average.

Note

If the readings obtained in this check vary by more than 0.06 mm from one another, there is something wrong with the installation of the ring gear or with the gear set itself. Check assembling steps and replace gear set if necessary.



Finding "Svo mean"

Example:

1st reading	= 1.10
+ 2nd reading	= 1.12
+ 3rd reading	= 1.13
+ 4th reading	= 1.11
Total	= 4.46

The maximum difference between the four readings is $1.13 - 1.10 = 0.03$ mm

$$\begin{aligned}
 \text{Svo mean} &= \text{Svo total} : 4 \\
 &= 4.46 : 4 \\
 &= 1.115 \\
 &= 1.12
 \end{aligned}$$

- 9 - Determine the thickness of S₁ shim (ring gear side). The thickness for S₁ shim can be determined from the backlash Svo mean as follows:

a) From table

For an Svo mean figure of 1.12 the table shows a shim "S₁" thickness of 0.92 mm.

Backlash Svo mean	Shim thickness mm	Backlash Svo mean	Shim thickness mm
0.20	0.00	0.70	0.50
0.21	0.01	0.71	0.51
0.22	0.02	0.72	0.52
0.23	0.03	0.73	0.53
0.24	0.04	0.74	0.54
0.25	0.05	0.75	0.55
0.26	0.06	0.76	0.56
0.27	0.07	0.77	0.57
0.28	0.08	0.78	0.58
0.29	0.09	0.79	0.59
0.30	0.10	0.80	0.60
0.31	0.11	0.81	0.61
0.32	0.12	0.82	0.62
0.33	0.13	0.83	0.63
0.34	0.14	0.84	0.64
0.35	0.15	0.85	0.65
0.36	0.16	0.86	0.66
0.37	0.17	0.87	0.67
0.38	0.18	0.88	0.68
0.39	0.19	0.89	0.69
0.40	0.20	0.90	0.70
0.41	0.21	0.91	0.71
0.42	0.22	0.92	0.72
0.43	0.23	0.93	0.73
0.44	0.24	0.94	0.74
0.45	0.25	0.95	0.75
0.46	0.26	0.96	0.76
0.47	0.27	0.97	0.77
0.48	0.28	0.98	0.78
0.49	0.29	0.99	0.79
0.50	0.30	1.00	0.80
0.51	0.31	1.01	0.81
0.52	0.32	1.02	0.82
0.53	0.33	1.03	0.83
0.54	0.34	1.04	0.84
0.55	0.35	1.05	0.85
0.56	0.36	1.06	0.86
0.57	0.37	1.07	0.87
0.58	0.38	1.08	0.88
0.59	0.39	1.09	0.89
0.60	0.40	1.10	0.90
0.61	0.41	1.11	0.91
0.62	0.42	1.12	0.92
0.63	0.43	1.13	0.93
0.64	0.44	1.14	0.94
0.65	0.45	1.15	0.95
0.66	0.46	1.16	0.96
0.67	0.47	1.17	0.97
0.68	0.48	1.18	0.98
0.69	0.49	1.19	0.99
0.70	0.50	1.20	1.00

b) By calculation

Product of "Svo mean" and correction factor "w":

$$\text{Svo mean} \times w$$

— ring gear lift "h":

$$- h$$

This gives us the following simple formula:

$$S_1 = \text{Svo mean} \times w - h$$

In this formula:

S_1 = Thickness of shim on ring gear side

Svo mean = Mean measured backlash with shims on opposite side of ring gear

w = Correction factor

h = Axial ring gear lift from no-play mesh position to mean backlash position.

In our example:

$$S_1 = 1.12 \text{ mm} \times 1 - 0.20 \text{ mm}$$

$$S_1 = 0.92 \text{ mm}$$

- 10 - Determine thickness of S_2 shim (opposite ring gear). Under "Adjusting tapered roller bearings", a value of 1.65 mm was obtained for the required total shim thickness "S". S_2 is obtained from the difference between "S" and S_1 as follows:

$$S_2 = "S" - S_1$$

$$S_2 = 1.65 \text{ mm} - 0.92 \text{ mm}$$

$$S_2 = 0.73 \text{ mm}$$

- 11 - Install S_1 shim on ring gear side and S_2 on other side.

- 12 - Install differential with **clamping sleeve VW 382/3** attached. Install cover without oil seal but with O-ring.

- 13 - Check backlash. It must be measured at four points 90° apart and should be:

$$\text{Svo} = 0.15 \text{ to } 0.25 \text{ mm}$$

Note

The individual readings must not differ from one another by **more than 0.05 mm**.

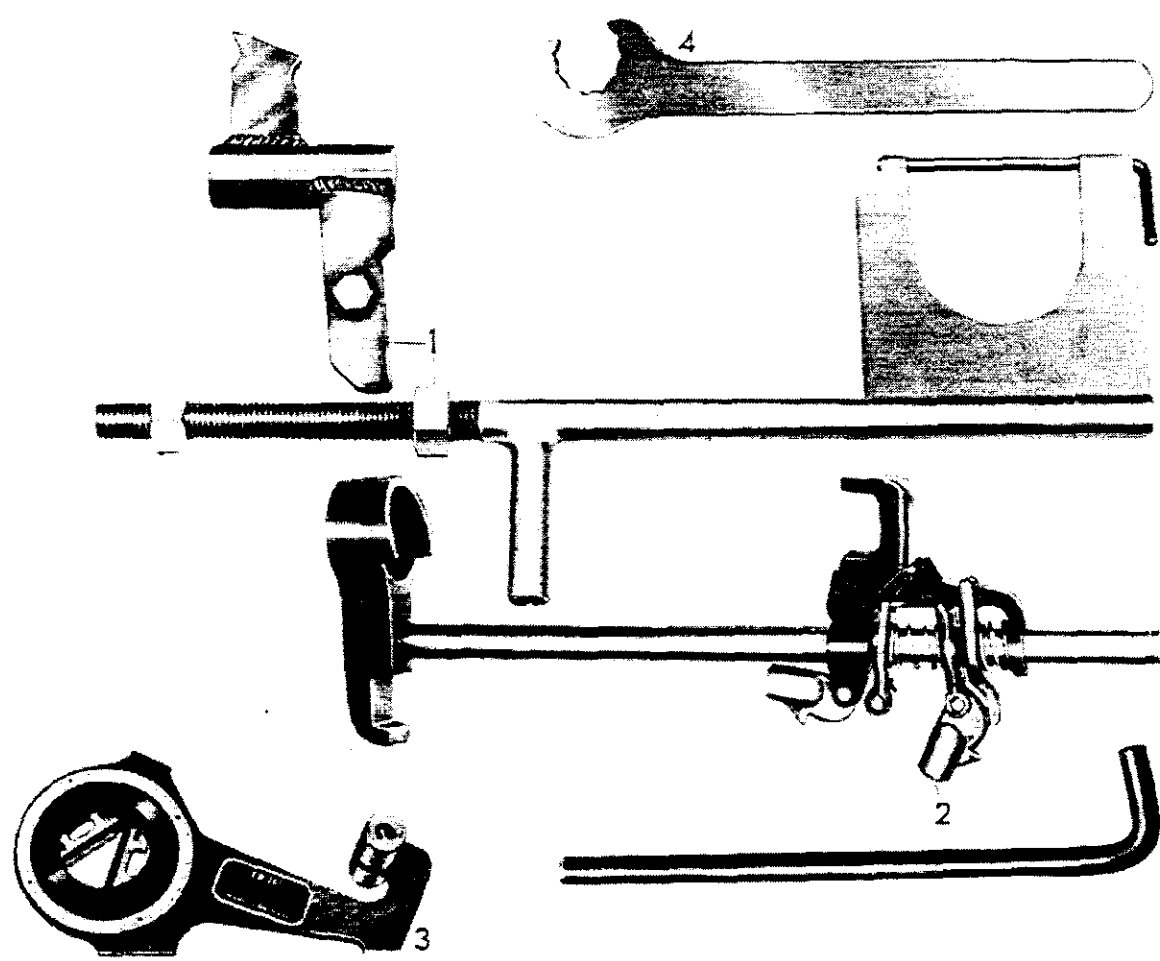
- 14 - Remove sleeve VW 382/3. Press oil seal into cover with tube VW 415a and assemble transmission.
See "Removing and installing differential" (H 5.1/11).

Gear set	Correction factor "w"	Lift "h"
G 833/835	1	0.20
K 833	1	0.20
K 835	1.10	0.22

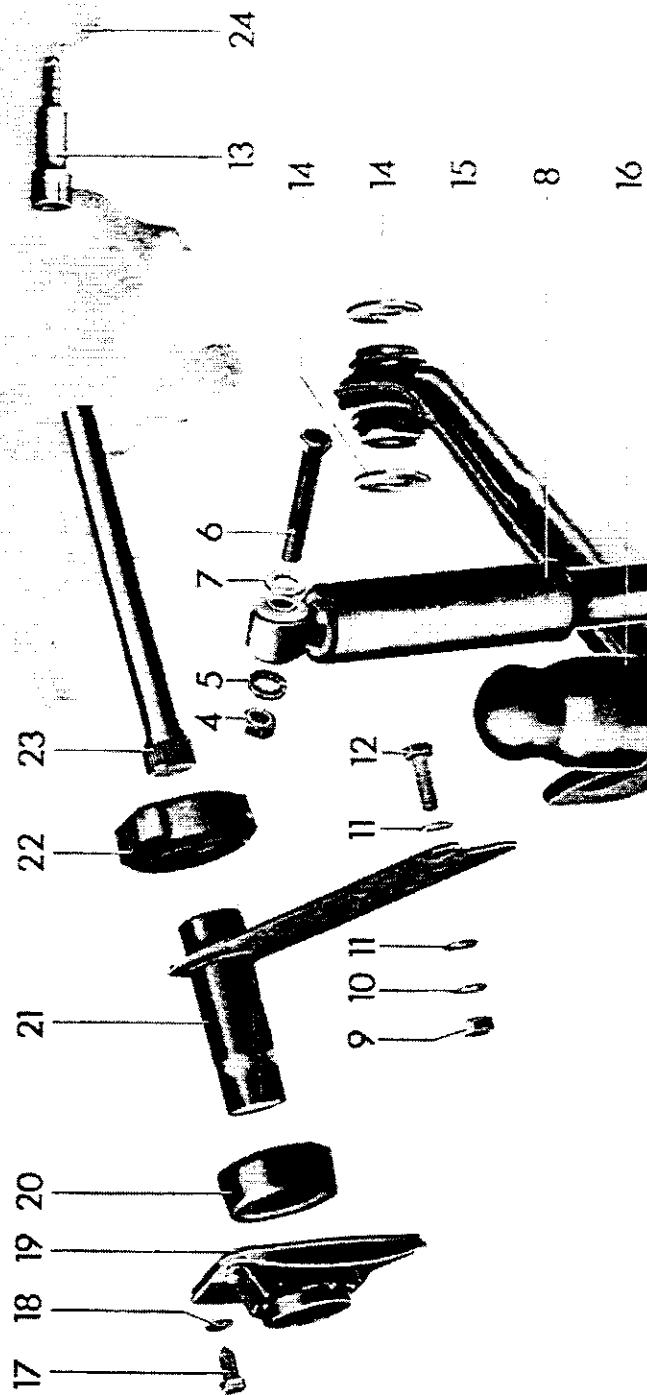
Shim No.	Part No.	Thickness
1	113 517 201 A	0.15
2	113 517 202 A	0.20
3	113 517 203 A	0.30
4	113 517 204 A	0.40
5	113 517 205 A	0.50
6	113 517 206 A	0.60
7	113 517 207 A	0.70
8	113 517 208 A	0.80
9	113 517 209 A	0.90
10	113 517 210 A	1.00
11	113 517 211 A	1.20

nominal shim thickness as found for S_1 or S_2	Shim thickness	Shim No.
0.28—0.32	0.30	3
0.33—0.37	0.35	1+2
0.38—0.42	0.40	4
0.43—0.47	0.45	1+3
0.48—0.52	0.50	5
0.53—0.57	0.55	1+4
0.58—0.62	0.60	6
0.63—0.67	0.65	1+5
0.68—0.72	0.70	7
0.73—0.77	0.75	1+6
0.78—0.82	0.80	8
0.83—0.87	0.85	1+7
0.88—0.92	0.90	9
0.93—0.97	0.95	1+8
0.98—1.02	1.00	10
1.03—1.07	1.05	1+9
1.08—1.12	1.10	2+9
1.13—1.17	1.15	1+10
1.18—1.22	1.20	11
1.23—1.27	1.25	1+5+6
1.28—1.32	1.30	3+10

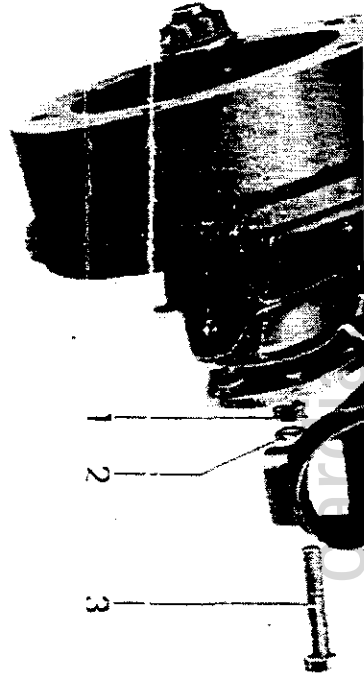
The shims should be measured **carefully at several points** with a micrometer. Check shims for burrs or damage.



No.	Description	Special Tool	Remarks
1	Tensioner	US 4437	
2	Tensioner	VW 655 3	
3	Protractor	VW 261	
4	Special wrench	VW 179	



No.	Description	Qty.	Note when removing	Note when installing	Special instructions
1	Nut M 12, galvanized	1		tighten to 6 mkg (43 lb ft)	
2	Spring washer, galvanized	1			
3	Bolt M 12 x 70, galvanized	1			
4	Nut M 12	1		tighten to 6 mkg (43 lb ft)	
5	Spring washer	1			
6	Bolt M 12 x 80	1			
7	Washer	1			
8	Shock absorber	1		check for operation, replace if necessary	
9	Nut M 12	3		tighten to 11.5 mkg (83 lb ft)	
10	Spring washer	3			
11	Washer	6			
12	Nut M 12 x 35	3			
13	Special bolt	1		tighten to 12.5 mkg (90 lb ft) and secure	
14	Spacer	2	note installation position	install correctly, adjust diagonal arm if necessary	
15	Diagonal arm, assembly	1		inspect for damage	
16	Rubber stop	1			
17	Bolt M 10 x 22	3		tighten 3.5 mkg (25 lb ft)	
18	Spring washer	3			
19	Cover, spring plate hub	1			
20	Outer rubber bushing	1		install with talcum powder	
21	Spring plate	1	pry off	use VW 655/3	
22	Inner rubber bushing	1		install with talcum powder	
23	Torsion bar 24 mm (0.945 in.) diameter	1		left and right side different, note marking: L = left, R = right, adjust	
24	Frame	1			



Removing

- 1 - Loosen slotted nuts.

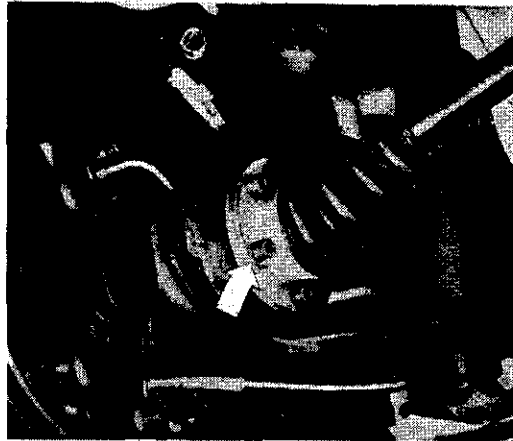
Warning

Do not loosen or tighten the slotted nuts of the axle shafts with the vehicle on a hoist. Loosen and tighten nuts with the vehicle standing on its wheels only.

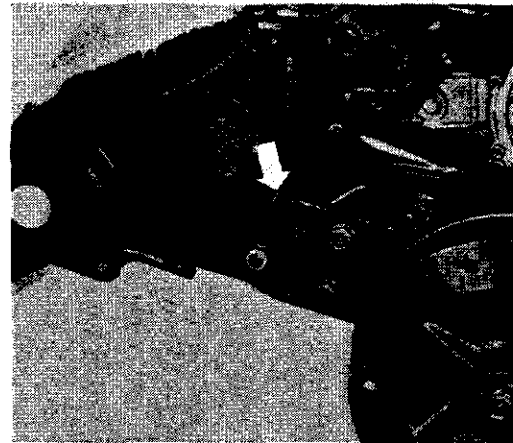
- 2 - Detach drive shaft at wheel end and protect joint with plastic cap.
- 3 - Remove lower shock absorber bolt.
- 4 - Remove slotted nut and pull brake drum off. Detach brake line and parking brake cable from backing plate.

Note

If only the wheel bearings are to be disassembled, remove the brake drum and backing plate but do not disconnect the brake line and parking brake cable. Hang backing plate on vehicle with a piece of wire (see H 7.2/4).



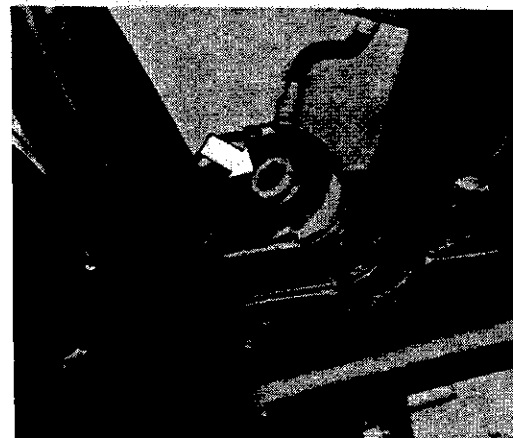
- 5 - Mark location of spring plate and diagonal arm with a chisel (arrow).
- 6 - Remove nuts and bolts holding the diagonal arm on the spring plate.



- 7 - Remove special bolt attaching arm to bracket (arrow) and take arm off.

Note

Note location of spacers. They must be put back in the same place.



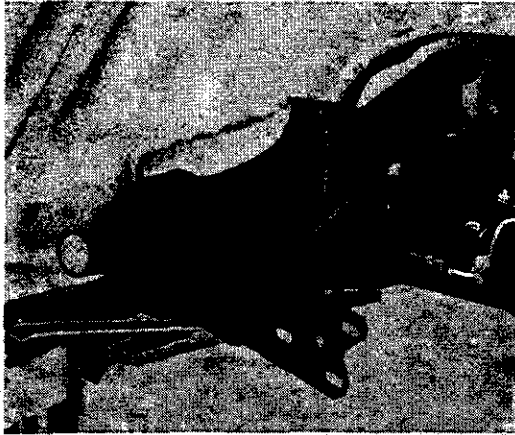
H7.2

Suspension (Double-joint axle)

- 8 - Remove bolts of cover on spring plate hub and take cover off.

Note

The spring plate can also be removed with the diagonal arm installed.



- 9 - Lift spring plate off lower stop with a lever.

- 10 - Take spring plate off and pull torsion bar out.

Note

Pieces of broken torsion bars can be pulled out with a tube which has been opened up at one end or by removing the opposite torsion bar and knocking out with a long drift.

Installing

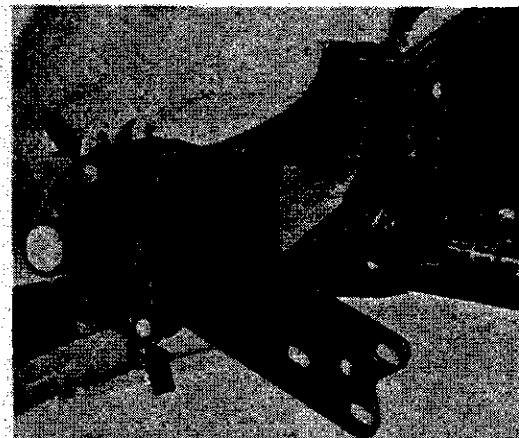
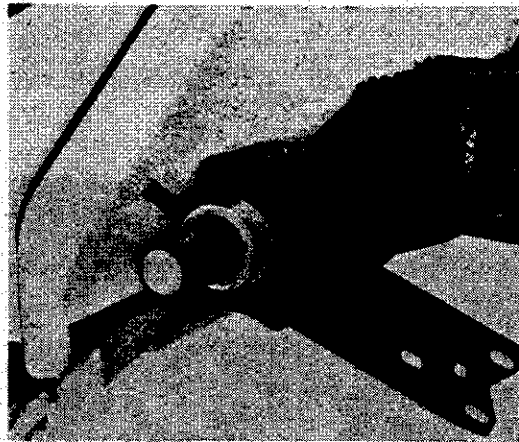
Check torsion bar, rubber bushings and spring plates for wear and damage and replace parts if necessary.

Caution

- a - Damaged places in the protective paint on the bars must be touched up with paint in order to avoid fatigue fractures due to corrosion.
 - b - The torsion bars are prestressed in the working direction and must not be interchanged. The left bar has an "L" on the end face and the right bar has an "R".
- 1 - Grease torsion bar splines before inserting.
 - 2 - Coat inner rubber bushing with talcum powder before installing.

Note

- a - When installing the rubber bushings, note that the marking "oben" is at the top. Inner and outer bushings are different.
 - b - Coat bushings with talcum and not with graphite. All rubber bushings are intended to remain stationary on inner and outer surfaces and twist internally. If coated with graphite powder, the spring plate turns in the bushings and wears them out prematurely.
- 3 - Install spring plate and outer bushing and adjust torsion bar. See H 7.2/3.
- Caution**
- When a spring plate is replaced, the position of the rear wheels must be checked on an axle alignment stand and set correctly.
- 4 - Mount spring plate hub cover with two bolts (arrows), using longer bolts if necessary.



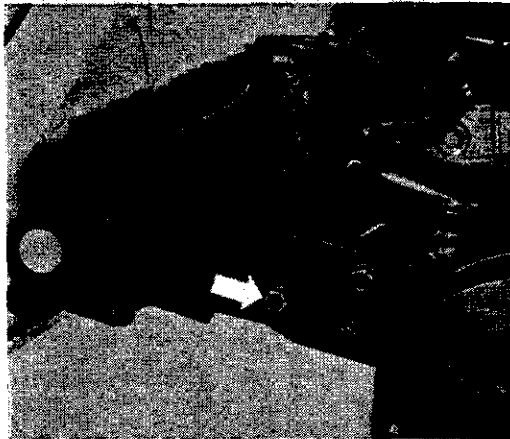


- 5 - Lift spring plate to lower stop with tensioner VW 655/3 and tighten the bolts in hub cover.

Caution

Use only the tensioner VW 655/3. Place it at the end of the spring plate. The upper bracket must be hooked between the body and support.

- 6 - Install remaining bolts in the cover and replace the two long bolts (if used) with the standard bolts. Tighten all bolts to correct torque.
- 7 - Attach diagonal arm to frame and insert special bolt. Do not tighten. Note location of spacers.



- 8 - Attach arm to spring plate. Watch the alignment marks. Tighten the nuts and bolt to correct torque. When adjusting the wheel toe with vehicle standing on its wheels the arm will slip to this position on its own.

Note

When a diagonal arm is replaced, the position of the rear wheel of that side must be checked on an axle alignment stand and rectified as required.



- 9 - Lift spring plate with VW 655/3 so that there is an angle of 4°35' between horizontal line and spring plate.

Note

In this position tighten special bolt to correct torque. Then lock bolt.

Note

To prevent tension in the bonded rubber bushings slightly tighten the special bolt in this position. Tighten afterwards to final torque. Lock bolt by peening the metal shoulder on bracket (arrow). If a diagonal arm was replaced, check the adjustment of drive shaft and correct if necessary (See H 7.2/3).

- 10 - Attach backing plate and bearing cover for rear wheel shaft to diagonal arm and tighten bolts to **correct torque**.
- 11 - Grease joint lightly and install shaft. Tighten socket head screws to **correct torque**. Use new lock washers and install them with the convex side towards the screw head.

Note

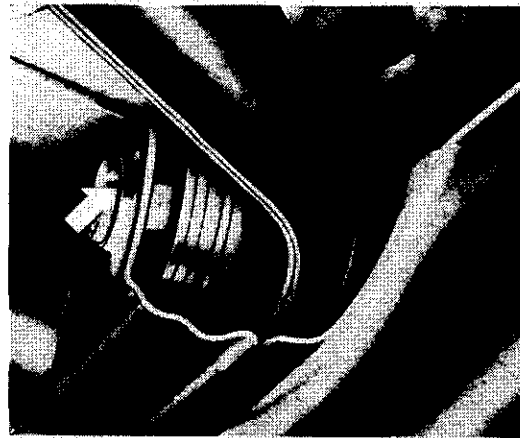
The contact surfaces of shaft flange and joint must be free of grease.

- 12 - Install brake drum, tighten slotted nut to **correct torque** and secure with cotter pin.

Warning

Do not loosen or tighten the slotted nuts with the vehicle on a hoist.
Loosen or tighten the nuts with the wheels of the vehicle on the ground.

- 13 - Bleed and adjust brakes.



H7.2 Suspension (Double-joint axle)

Adjusting

The setting angle for the torsion bar is given in degrees with bar free of load and in relation to the longitudinal vehicle axis. If the protractor VW 261 is used (the spirit level works from the horizontal), the deviation between the vehicle longitudinal axis and true horizontal must be found first and taken into account in the setting angle.

The torsion bars have different numbers of splines on the ends,

**inner end 40 splines,
outer end 44 splines,**

so that turning the torsion bar inner end one spline alters the angle 9° , and turning the spring plate back one spline alters the angle $8^\circ 10'$. This means that the smallest possible alteration is $50'$.

Note

On vehicles with high mileage, always adjust both torsion bars because the bars tend to settle in use.

- 1 - Determine deviation of vehicle axis from the horizontal and note the reading.

CORRECT SETTING
 $20^\circ \pm 30'$

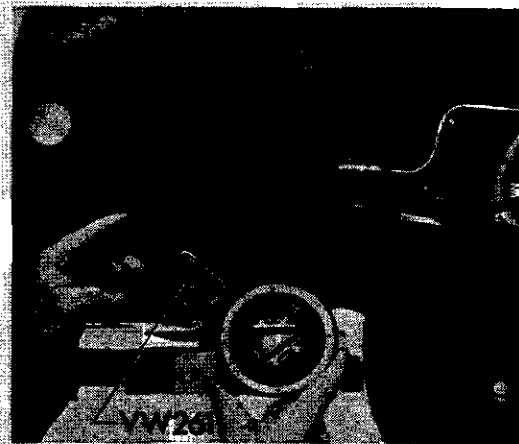
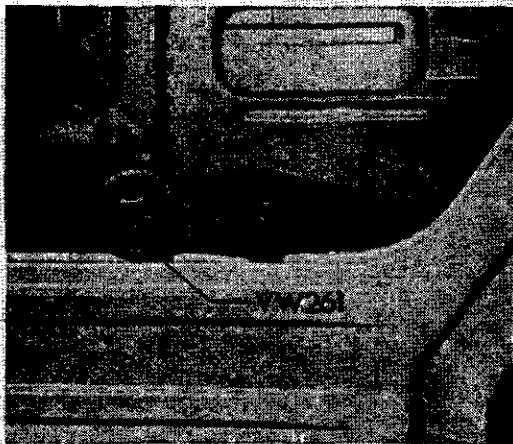
TWENTY ^{30 MIN} DEGREES
PLUS OR MINUS
30 MINUTES

60 MINUTES = 1 DEGREE

- 2 - Place spring plate on torsion bar, position protractor VW 261 on plate and measure angle. Lift the plate while measuring the angle in order to eliminate the play in the splines.

- 3 - If the angle deviates more than $50'$, the angle must be corrected.

- 4 - According to the deviation, turn torsion bar one spline forward or back and spring plate one spline in the opposite direction.



Adjusting rear axle

The power unit consisting of the engine, transmission and final drive is attached to the frame cross tube at the front with a bonded rubber mounting. At the rear it is supported by a carrier which is bolted to the engine and secured to each side of the body with rubber bushings.

The independently suspended wheels are located by semi-trailing arms and trailing links. The trailing link which is usually referred to as the spring link is bolted to the wheel bearing housing and splined on to the transverse torsion bars. The semi-trailing arm is a fabricated sheet metal construction (diagonal arm) which is mounted on a bracket welded to the cross tube. This suspension arrangement is designed to give a slight variation in camber angle which ensures optimal road holding under all load conditions.

Torque is transmitted from the flanges on the final drive to the wheel shafts via short drive shafts with two constant velocity joints per shaft. The sliding travel in the constant velocity joints compensates for all changes which occur in the distance between the flanges on the final drive and those on the wheel shafts. In order to prevent the sliding movement from being restricted due to varying manufacturing tolerances, the space between the wheel shaft flanges must be set correctly with the suspension at the bottom of its movement. The engine/transmission unit must also be centralized between the wheel shaft flanges.

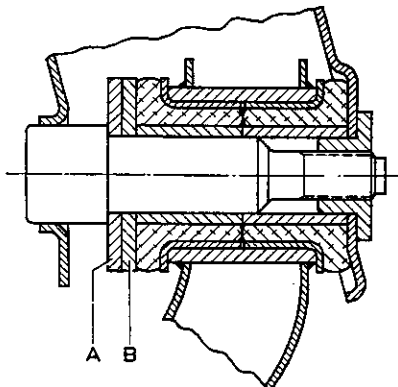
Type 1 / Model 181 vehicles with double-joint axles must be adjusted as follows.

In order to make it possible to adjust the suspension when a diagonal arm has been replaced or accident damage repaired, the following checks and adjustments are provided on the rear axle:

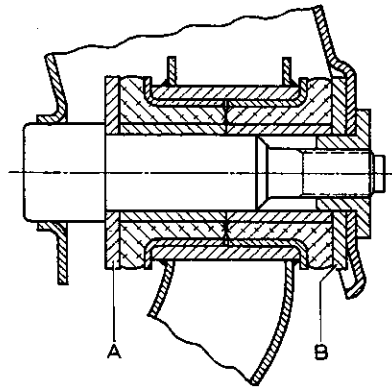
- a - The space between the wheel shaft flanges and the centralization of the engine/transmission unit is checked with suspension at the bottom of movement by using a ruler. This check also provides an direct check on the sliding travel of the constant velocity joints.
- b - The diagonal arm can be moved laterally by moving two adjusting washers A and B. This adjusts the distance between the wheel shaft flanges.
- c - The spring plate, which is made up of two plates is bolted to the diagonal arm with four bolts. The holes in the double spring plate are elongated so that the wheel track angle can be adjusted by moving the diagonal arm. As the wheel toe angle and the distance between the flanges are directly dependent on one another, the toe angle and diagonal arm setting must always be checked together when adjusting the rear axle.
- d - The rear engine mountings can also be moved sideways on the body so that the engine/transmission unit can be centralized.

There are two possibilities:

Version 1: both washers (A and B) outside



Version 2: one washer (A) outside, one inside (B)



H7.2

Suspension (Double-joint axle)

Adjusting rear axle

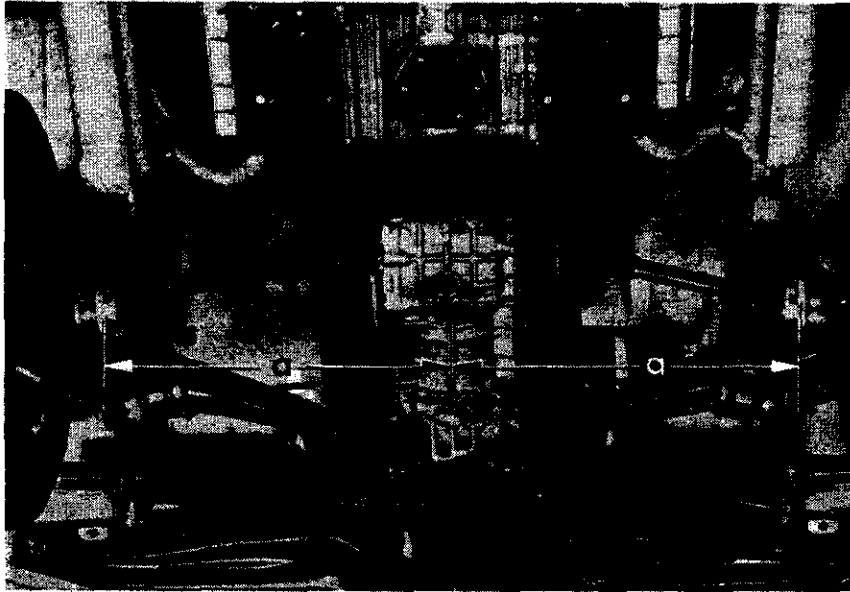
Checking

Before adjusting the rear axle in the vehicle check first dimension "a" (from center transmission case to flanges of driveshaft joints).

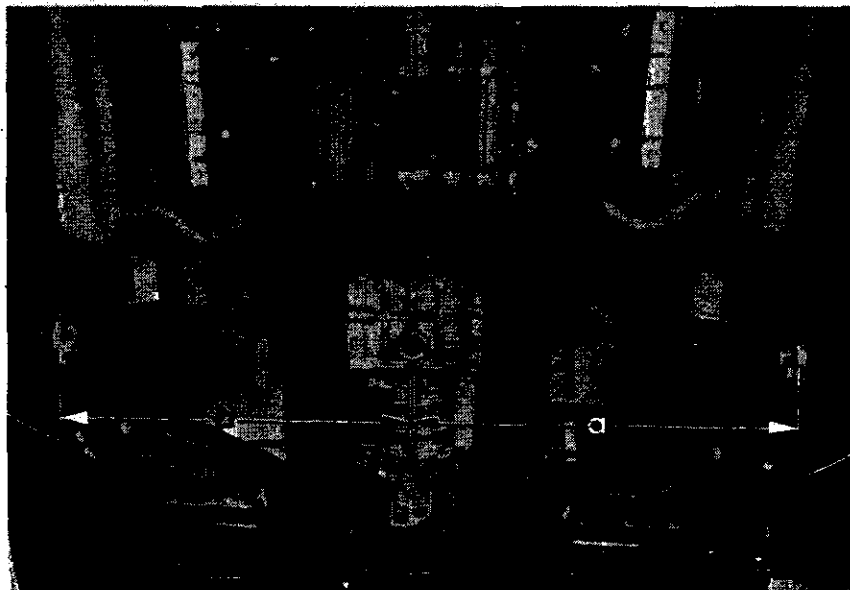
A = vehicle on a hoist (rear wheels off ground)

B = vehicle with rear wheels on ground

Check dimension with a ruler.



A - Vehicle on hoist, $a = 487.5 \pm 1.5 \text{ mm}$ ($19\frac{3}{16} \pm \frac{1}{16} \text{ in.}$)



B - Vehicle on ground, $a = 492.5 \pm 1.5 \text{ mm}$ ($19\frac{3}{8} \pm \frac{1}{16} \text{ in.}$)

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Adjusting

When adjusting the rear axle, start with the diagonal arm which is the largest amount out of line with the transmission center.

- 1 - Remove nuts holding spring plate but do not take bolts out.
- 2 - Remove fitted bolt in diagonal arm with a 17 mm socket wrench.
- 3 - Press diagonal arm to one side with a lever until adjusting washer can be moved.
- 4 - Install the fitted bolt in diagonal arm.
- 5 - Install nuts in spring plate bolts and tighten slightly.
- 6 - Align vehicle properly on optical measuring stand and set wheel toe angle **on both sides** with VW 160 and VW 179. When tightening the spring plate bolts watch the angle between arm/plate. (H 7.2/3).
- 7 - Centralize the engine/transmission assembly by moving the engine mountings in the elongated holes in the body side members.

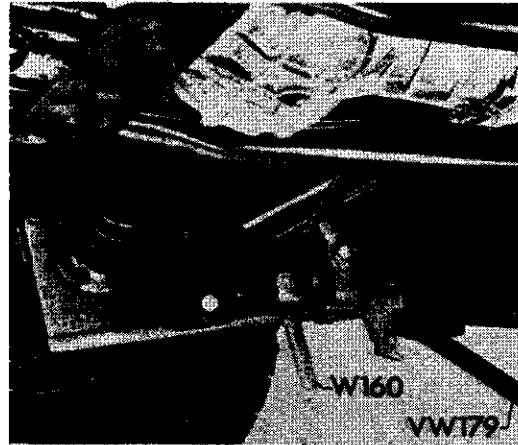
Note

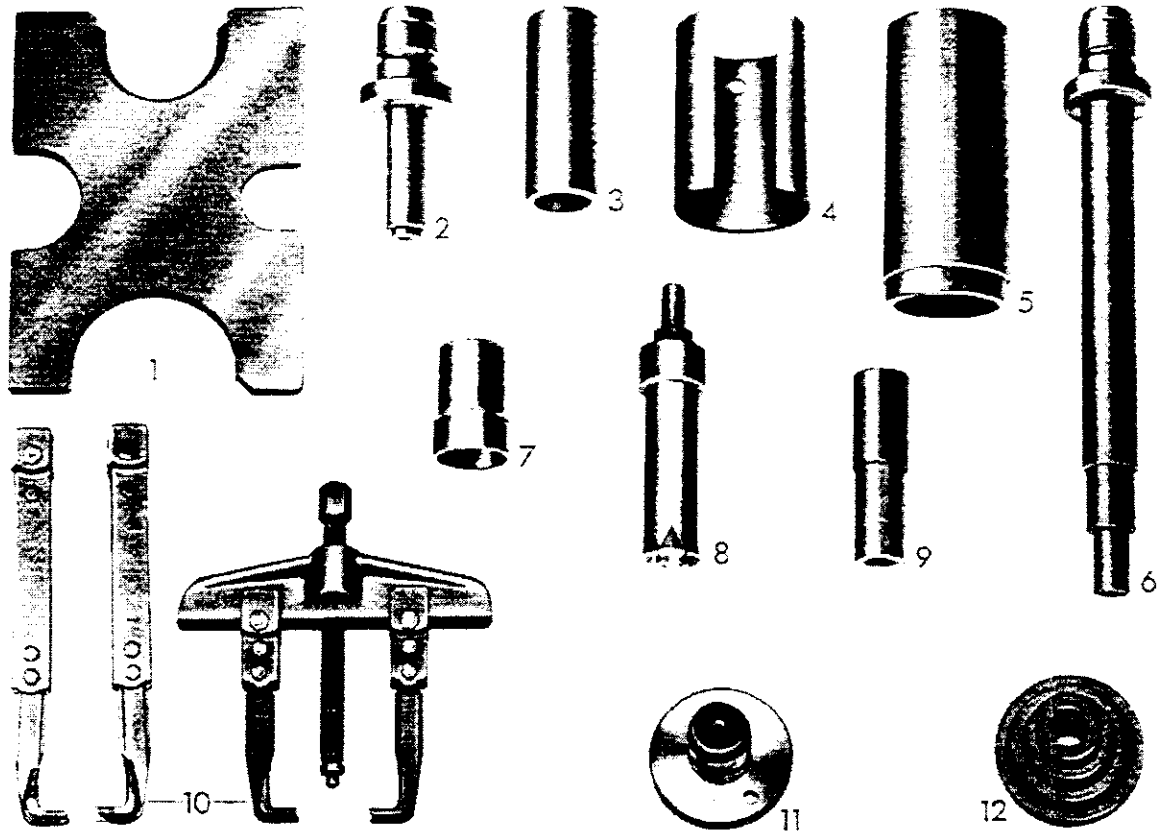
There are two adjusting washers on each diagonal arm. It is necessary to install at least one of the washers on the outside. This means that there are only two alternative adjustments for each arm:

One adjusting washer outside and one inside.

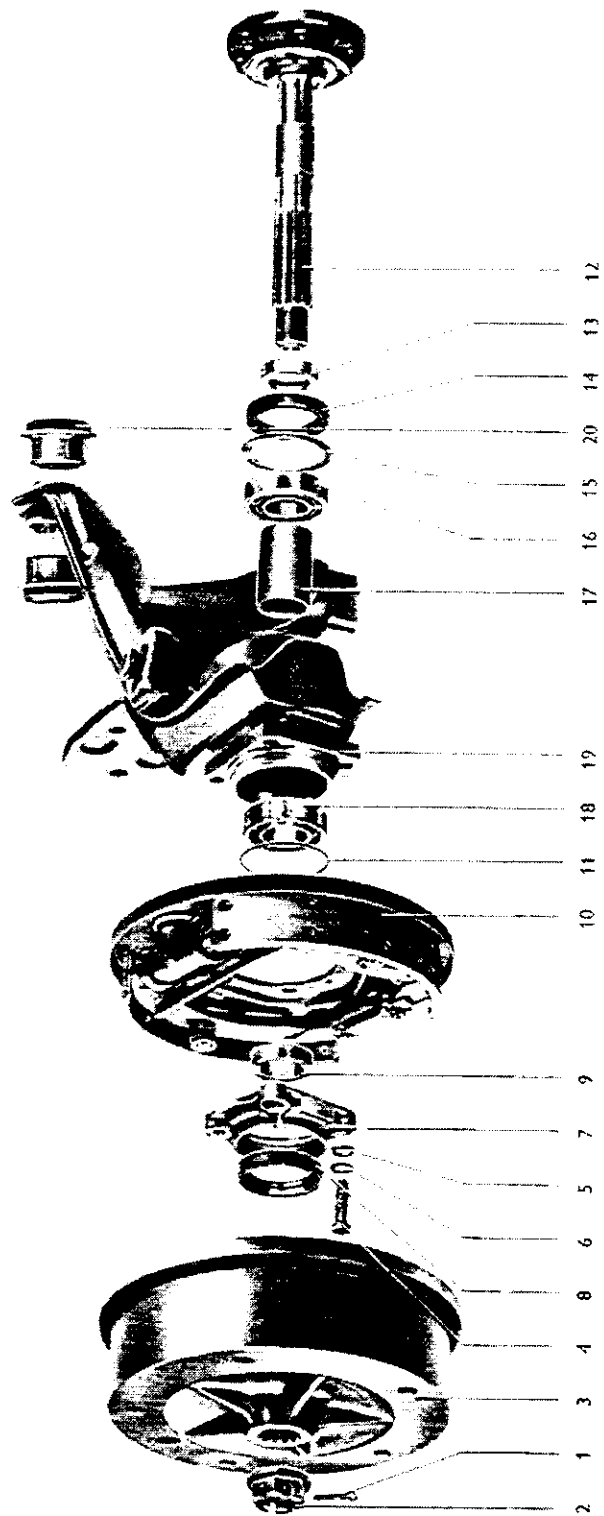
- 8 - Install fitted bolt, tighten and secure by peening.

Both adjusting washers outside.





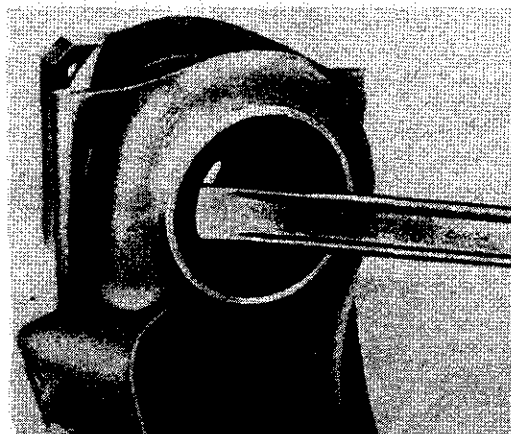
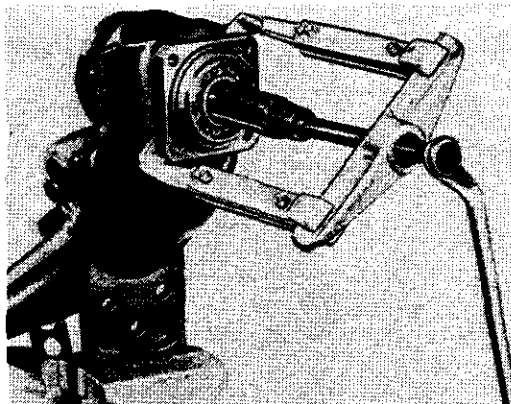
No.	Description	Special Tool	Remarks
1	Plate	VW 402	
2	Press tool	VW 409	
3	Thrust tube	VW 416 b	
4	Removing tool	VW 463/3	
5	Thrust tube	VW 415 a	
6	Press tool	VW 408 a	
7	Thrust sleeve	VW 454	
8	Extractor	—	local purchase item
9	Thrust tube	VW 421	
10	Puller	US 1078/79	
11	Press tool	VW 412	
12	Press tool	VW 474	



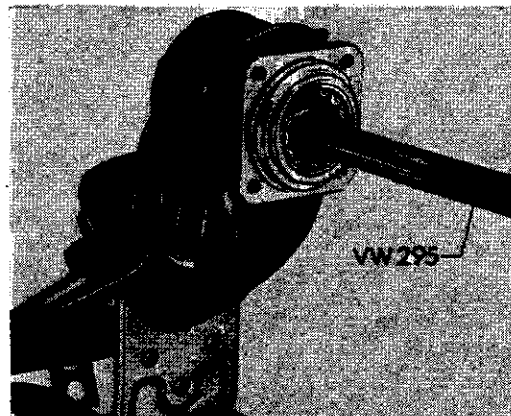
No.	Description	Qty.	Note when	Special instructions
1	Coiler pin 5 x 45	1	replace	
2	Slotted nut M 24 x 1.5	1	tighten to 35 mkg (253 lb ft)	
3	Brake drum	1	clean, check for wear or damage and thread for wheel bolts	
4	Bolt	4	tighten to 6 mkg (43 lb ft) use only bolts of tensile class 10 K	
5	Washer	4		
6	Spring washer	4		
7	Bearing cover	1		
8	Oil seal, outer	1	pry out with lever	replace, press in with VW 474
9	Spacer, outer	1	check for wear, replace if necessary	
10	Backing plate, assembly	1		
11	O-ring	1		
12	Rear wheel shaft	1	drive out with punch or pull out with puller	drive in with rubber hammer
13	Spacer, inner	1	check for wear, replace if necessary	
14	Oil seal, inner	1	pry out with lever	drive in with VW 415 a, or press in with VW 402, VW 412 and VW 415 a
15	Circlip 62 x 2	1	check for proper seating	
16	Ball bearing	1	drive out with VW 295	check for wear, drive in with VW 415 a, or press in with VW 402, VW 412 and VW 415 a
17	Spacer sleeve	1		
18	Roller bearing	1	drive out with punch	drive in with VW 415 a
19	Diagonal arm	1	fill with multipurpose grease	
20	Bonded rubber bushing	2	check for wear, replace if necessary, note installation position, notes of bushings must be horizontal	

Disassembling

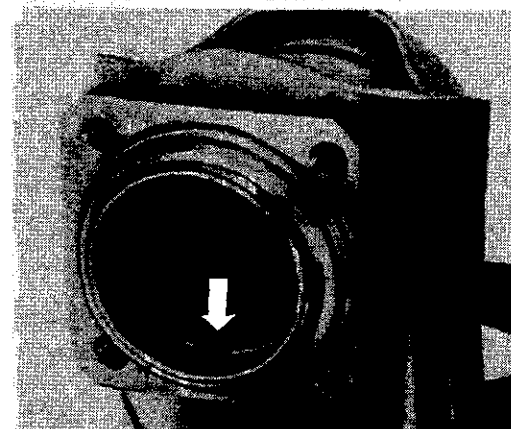
- 1 - Clamp diagonal arm flange in the vise.
- 2 - Remove slotted nut and brake drum.
- 3 - Remove bolts holding bearing cover, take off cover with O-ring, outer spacer and backing plate.
- 4 - Knock shaft out with a soft drift or press it out with a puller and 250 mm (10 in.) jaws. Take inner spacer out.
- 5 - Pry inner oil seal out.



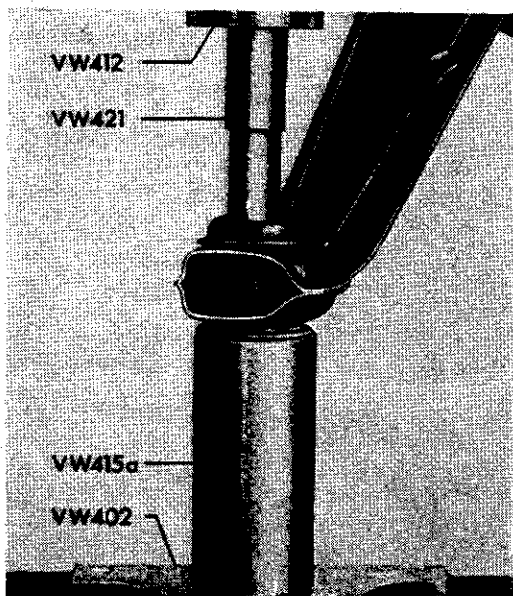
- 6 - Take circlip off and knock ball bearing out with a drift (such as VW 295).



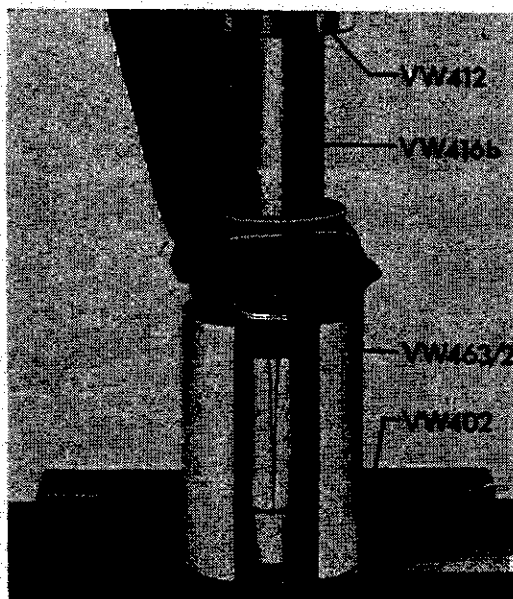
- 7 - Take out spacer sleeve, inner race of roller bearing and drive the outer race (arrow) out with a drift.



H7.2 Suspension (Double-joint axle)



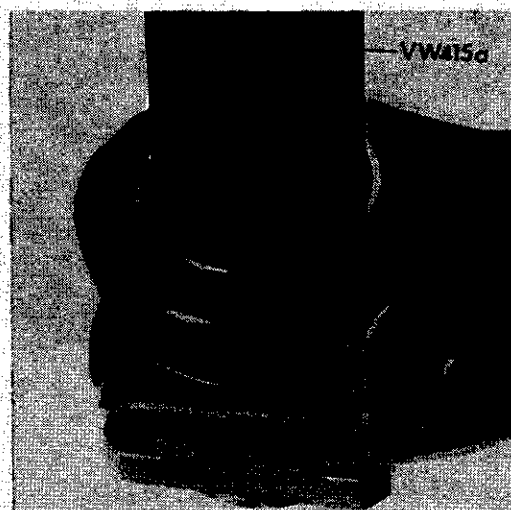
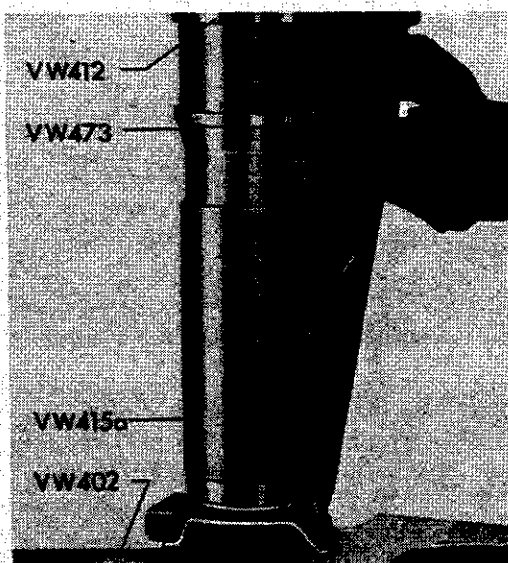
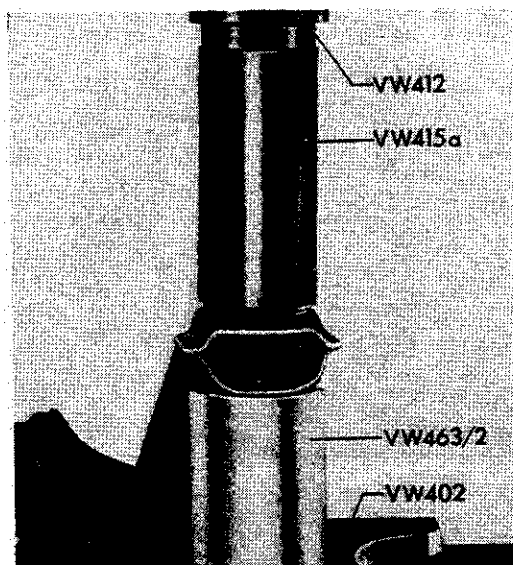
8 - Press inner sleeve of bonded rubber bushing out with VW 402, VW 412, VW 415a and VW 421.



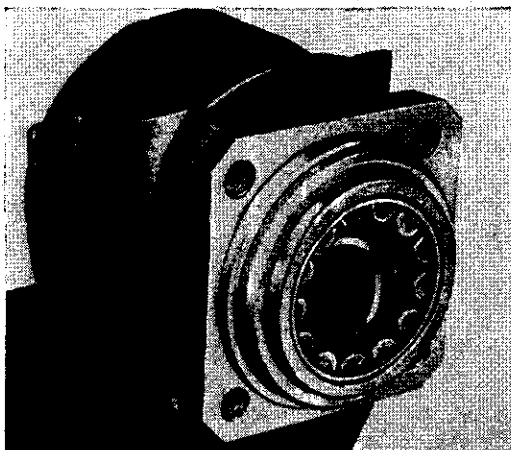
9 - Press outer sleeve of bonded rubber bushing out with VW 402, VW 412, VW 416b, 463/2 and internal extractor.

Assembling

- 1 - Check bonded rubber bushing, oil seals, wheel shafts and spacer rings for wear and damage or scoring. Replace damaged parts.
- 2 - Press one bonded rubber bushing in with VW 402, VW 412, VW 415a and VW 463/2.
- 3 - Press second bonded rubber bushing in with VW 402, VW 412, VW 415a and VW 473.
- 4 - Drive ball bearing in with VW 415a or press it in with VW 402, VW 412 and VW 415a.



H7.2 Suspension (Double-joint axle)

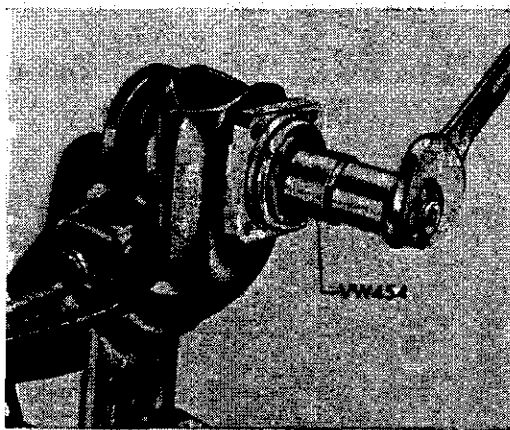


5 - Install circlip and drive oil seal in with VW 415a or press it in with VW 402, VW 412, VW 415a and VW 441.

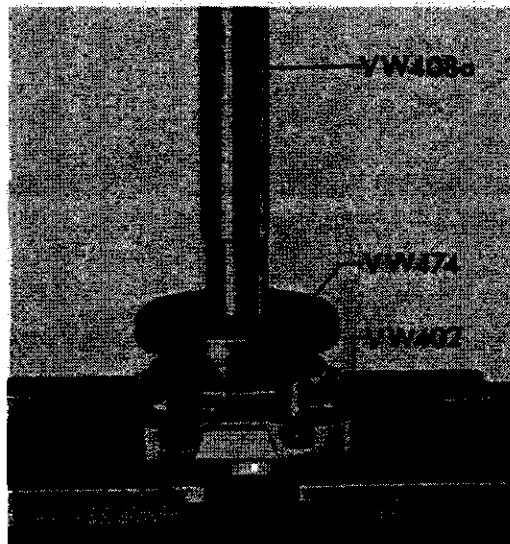
6 - Fill multi-purpose grease into hub of diagonal arm and grease ball bearing and oil seal lip. Drive shaft in or press it in lightly against bearing inner race with VW 402, VW 412 and VW 463/2.

7 - Install spacer sleeve. Grease outer race of roller bearing and drive it in with VW 415a.

8 - Drive in rear wheel shaft with rubber hammer.



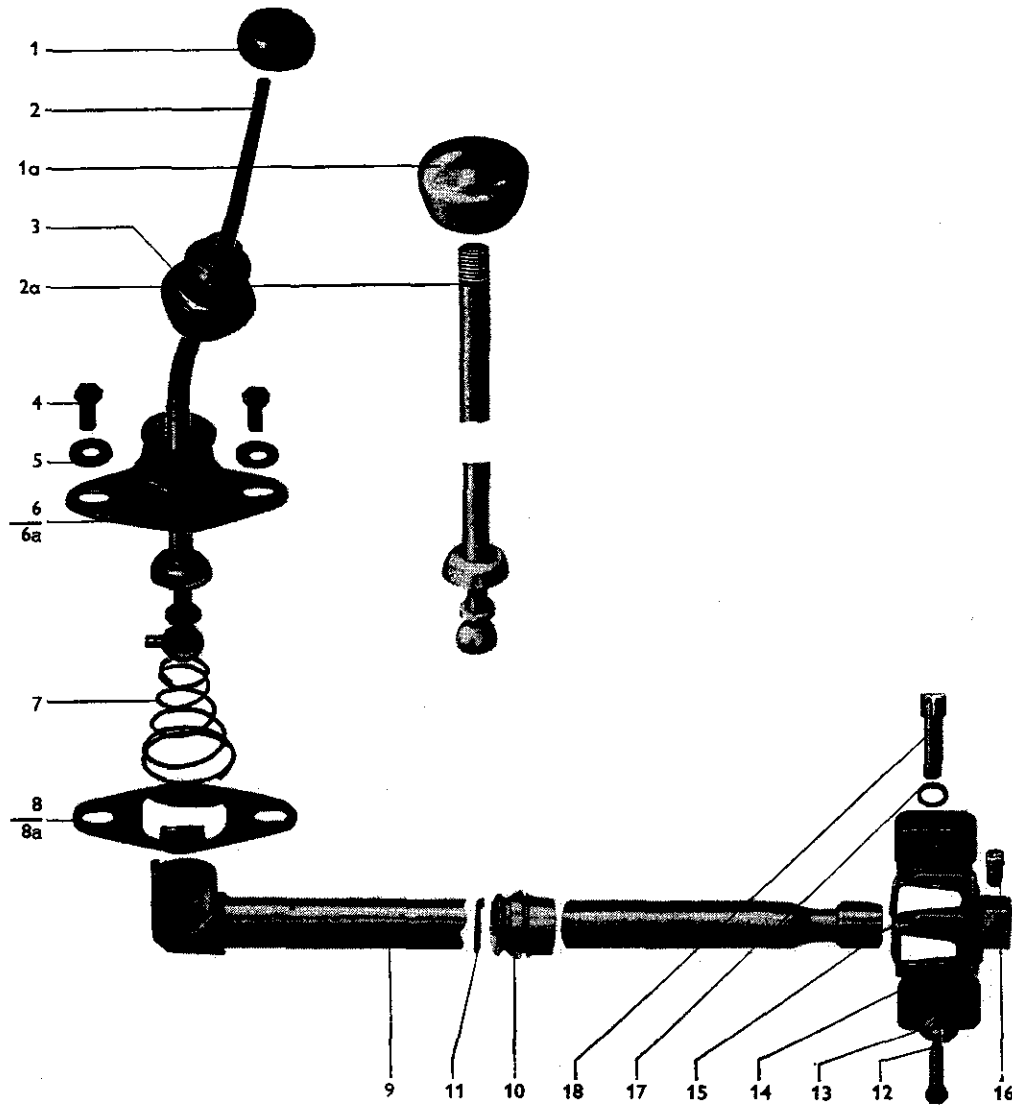
9 - Press bearing inner race in with outer spacer and VW 454 by tightening slotted nut.



10 - Press oil seal into bearing cover with VW 402, VW 408a and VW 474. Fill double lip of seal with grease.

11 - Install backing plate and bearing cover, spacer and new O-ring. Tighten bolts to correct torque.

12 - Install brake drum and slotted nut.



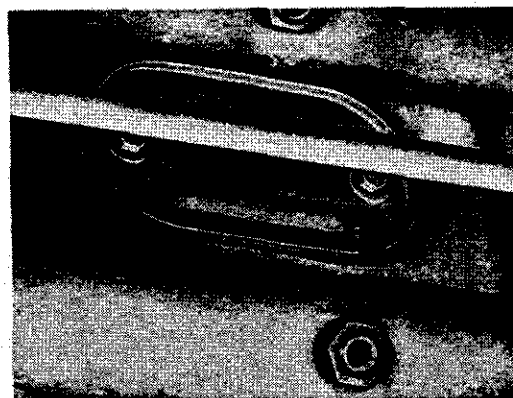
H8.1 Manual Transmission

No.	Description	Qty.	removing	Note when installing	Special instructions see
1	Knob	1		M 7 x 1 thread	
1a	Knob	1		M 12 x 1.5 thread	from Chass. No. 118 000 001
2	Gearshift lever	1		with pin in ball	
2a	Gearshift lever	1			straight from Chass. No. 118 000 001
3	Bellows	1			
4	Bolt M 8 x 20	2		2 mkg (14 lb ft)	
5	Spring washer 8.1 x 22	2			
6	Bracket	1		adjust	
6a	Bracket	1		adjust	from Chass. No. 112 2 000 001
7	Spring	1			
8	Stop plate	1		adjust	
8a	Stop plate	1		adjust	from Chass. No. 112 2 000 001
9	Gearshift rod	1		with slot in ball socket	
9a	Gearshift rod	1		without slot in ball socket	from Chass. No. 118 000 001
10	Sleeve	1		coat with Molykote	
11	Ring	1			
12	Hex. head sheet metal screw	1			
13	Locking cap	1			
14	Insert	2			
15	Housing	1			
16	Square head screw	1			
17	Washer	1			
18	Spring pin	1		coat with multi-purpose grease	

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Removing

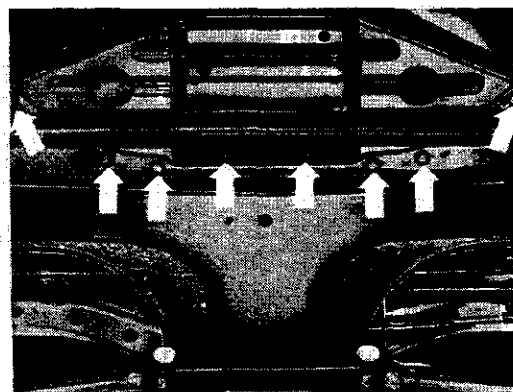
- 1 - Remove bolts holding gearshift lever bracket and take out lever, bracket, spring and stop plate.
- 2 - Remove plate over access hole in frame fork, remove securing wire (arrow) and take out square headed screw with wrench VW 114.
- 3 - Remove sheet metal screw from spring pin in shift rod coupling and take coupling off.
- 4 - Remove plate in front apron. Loosen bolts (arrows) and take cover plate and gasket off frame head.

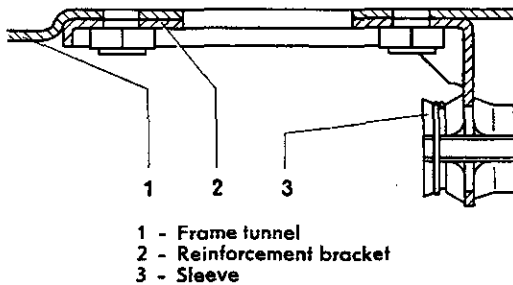
**Sedan 111****Sedan 113**

- 5 - Slide shift rod forward with a pair of pliers. Pull it out through opening in frame head.

Note

On vehicles with the deformation element in front of the frame head first remove all bolts (arrows) in order to remove the element and then the cover plate.





Installing

- 1 - Check shift rod, coupling, gearshift lever, spring, bracket and guide sleeve for wear and replace parts as necessary.

Note

If the gearshift lever is angled, a shift rod with a slot in the ball socket must be used. Be sure that the correct lever and rod are installed.

- 2 - Grease entire length of shift rod and slide it into frame tunnel.
- 3 - Slide guide sleeve into the front guide bracket and install retaining ring. Grease sleeve.

Note

The sleeve is correctly installed when the slot is at the side.

- 4 - Push the shift rod through the front guide to the rear until the ball socket is in the center of the hole in the frame tunnel. Install frame head plate and gasket and front apron plate.
- 5 - Install shift rod coupling, insert the spring pin and tighten sheet metal screw.
- 6 - Install coupling on inner shift lever, tighten square headed screw with VW 114 and secure it with wire. Install cover plate on frame fork.
- 7 - Assemble gearshift lever. Install bracket, push bellows on and screw knob on.

Note

Coat bracket, ball and socket in shift rod with multi-purpose grease.

- 8 - Install spring and stop plate. The longer raised edge must be on the right. Install gearshift lever and tighten bolts or bracket.

Note

If the shift rod or gearshift lever rattles, check the guide sleeve and the retaining ring. If the gearshift lever rattles in the ball socket of the shift rod, it can be remedied by filling the ball socket of the rod with thick grease or by installing a gearshift lever with a ball which is at the upper tolerance.

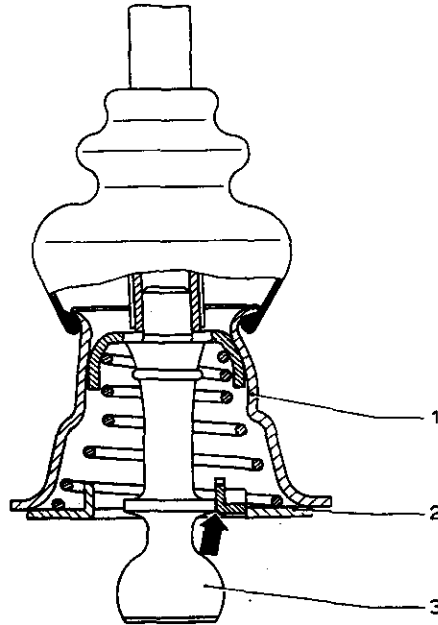
Adjusting shift linkage

- 1 - Shift into second gear and loosen bolts in bracket.

Note

During the following operation the clutch pedal should be depressed.

- 2 - Align gearshift lever carefully in the second gear position. It must be exactly vertical in the transverse direction and inclined to the rear about 11° in the longitudinal direction.
- 3 - With a screwdriver, push the stop plate under the bracket to the left until it touches the shoulder on the lever (arrow). The gear lever must be moved by the plate.
- 4 - Tighten the bolts holding the bracket in this position. It should now be possible to move the lever sideways about 15 to 20 mm ($\frac{5}{8}$ to $\frac{3}{4}$ in.) — measured at knob — with second gear engaged.
- 5 - Shift into all gears a few times, moving gearshift lever carefully in the H pattern. Do not try to move lever diagonally. The gears should engage easily and without jamming. Check that the reverse gear safety catch is effective.



1 - Bracket
2 - Stop plate
3 - Gearshift lever

Modification

From Chassis No. 112 2 000 001 / August 1971

The shift lever bracket and the stop plate were modified.

When installing the new parts, make sure that the slotted hole with the pointed end, is pointing to the front (arrow).

Otherwise shifting difficulties will occur when shifting in reverse.

